DISSERTATION ON

A COMPREHENSIVE STUDY ON INTESTINAL STOMAS

M.S. DEGREE EXAMINATION

BRANCH-I

GENERAL SURGERY

GOVERNMENT KILPAUK MEDICAL COLLEGE

THE TAMILNADU DR.MGR MEDICAL UNIVERSITY

CHENNAI

APRIL 2014

CERTIFICATE

This is to certify that this dissertation titled **"A COMPREHENSIVE STUDY ON INTESTINAL STOMAS"** is the bonafide record work done by **Dr. UDAY PRASAD P.V,**submitted as partial fulfillment for the requirements of **M.S. Degree Examinations Branch I, General Surgery, April 2014.**

Prof. K. Kuberan, M.S
Dissertation Guide and Unit Chief
Department of General Surgery
Government Royapettah Hospital
Kilpauk Medical College
Chennai.

Prof. P.N.ShanmugaSundaram, M.S
Head of the Department,
General Surgery,
Government Kilpauk Medical College
Chennai.

DEAN

Kilpauk Medical College

TN Dr MGR Medical University

Chennai

DECLARATION

I, Dr. UDAY PRASAD P.V, solemnly declare that the dissertation submitted on the topic ***"A COMPREHENSIVE STUDY ON INTESTINAL STOMAS"*** is a bonafide work done by me from May 2011 to December 2013, towards partial fulfillment of the requirements of M.S Degree examinations, General Surgery, April 2014.

Chennai Dr. UDAY PRASAD P.V

Date

ACKNOWLEDGEMENT

I sincerely thank Prof.P.Ramakrishnan MD,DLO, the Dean, Kilpauk Medical College for granting me permission to carry out and successfully complete my dissertation work.I consider it a privilege to have done this study under the supervision and guidance of Prof. K. Kuberan M.S, who was a constant source of inspiration and guidance.

I am indebted to Prof K Pandyaraj MS, Prof. K. Ramasubramanian MS and Prof. S. UdayakumarMS for helping me through the process of completing my dissertation. Their invaluable advice has helped me complete the study on time.

I would also like to thank Dr. S. Thirunavukkarasu MS, Dr. Selvakumar MS and Dr. Anandakumar MS, for their valuable support and encouragement throughout the period of study.I would like to thank my fellow postgraduates for their suggestions and ideas and finally I would like to thank our patients for their gratitude and co-operation in this study.

ABSTRACT

BACKGROUND AND OBJECTIVES

Intestinal stomas are commonly constructed in an emergency as well as elective setting for a variety of indications. Historically associated with a high morbidity, evolution of skills on the part of the surgeon has lead to better understanding of the indications, technique of construction and management of a stoma. This study aims to evaluate the above mentioned parameters and hence improve the outcome of patients undergoing a stoma.

METHODS

50 patients admitted in Govt. Royapettah Hospital and later operated and managed with a stoma were closely followed up from the date of admission to the date of discharge and the various parameters were studied.

RESULTS

The indications, technique, complications and its management were studied in detail by following patients in person or through phone and the results were analyzed in detail.

INTERPRETATION AND CONCLUSION

Construction and management of stoma was associated with a few complications. Most patients however tolerated the procedure well and the overall compliance was satisfactory. Loop ileostomy was the commonly constructed stoma and the one associated with most complications. Transverse

loop colostomy was associated with no complications and was extremely well tolerated.

KEY WORDS

Intestinal stoma, complications, end colostomy,loop ileostomy, loop colostomy, Parastomal hernia, stomal prolapse, loop-end ileostomy.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Stomas are openings made on the surface of a part of a hollow viscus, usually a portion of the GIT in order to extrude its contents to the exterior. They can be made on a temporary or a permanent basis and can be constructed surgically on an emergency or elective basis. The various surgically constructed forms of stomas include gastrostomy, ileostomy and a colostomy.

Apart from stomas constructed from a portion of GIT, there are also various different types of stomas constructed from non GIT sites viz ureter and bladder which serve to direct a stream of urine either directly or through an intestinal conduit into an appliance fitted directly in the skin. There are many indications of a colostomy eg: a decompressing colostomy made to prevent further distention in a segment of a bowel with distal obstruction (eg: in obstructing large bowel cancers) or a diversion colostomy wherein , the stoma serves to divert the fecal contents to the exterior owing to resection of the more distal segment (eg: following abdominoperineal resection for rectal cancer). Similarly the ileostomy can also be fashioned as an end ileostomy (eg : following total proctocolectomy for fulminant ulcerative colitis) or as a loop ileostomy (eg : following anileal perforation too close to the ileo-cecal junction that has been primarily closed, or to protect the distal ileal pouch anal anastomosis). The indications and techniques of stomas are thus varied and the complications depend to an extent on the technical expertise of the surgeon.

Stoma is a life saving procedure and even though the first stoma was created more than 100 years ago, it continues as an important tool in the surgeons' armamentarium. The incidence of permanent stomas like the end colostomy and ileostomy has been decreasing due to more sphincter saving procedures and technological advancements in the form of stapling devices, however this has led to an increase in the incidence of temporary stomas like the loop ileostomy which are more difficult to manage. The surgeon's role does not end with mere construction of a stoma, but also continues in educating the patient in proper stomal care and in helping the patient deal with the emotional issues concerning it. Even though a stoma has evolved from a hastily constructed, foul smelling, unsightly structure to a more odorless, barely noticeable and a continent opening, the issues mentioned above continue to haunt patients. Hence I hope my research regarding the proper indication, technique and management of stomas would be well received by surgeons and would help in making accurate on table decisions and device post operative management strategies which would alter the life of many patients.

AIMS AND OBJECTIVES

1. To study the various indications of intestinal stomas.
2. To study the techniques of intestinal stomas.
3. To study the complications of intestinal stomas and their management.
4. To study the overall compliance of patients in whom a stoma was constructed.

REVIEW OF LITERATURE

HISTORY

Intestinal stomas are amongst the most important developments in surgical specialties. The first stoma was said to have been constructed nearly 200 years ago and as of now there are an estimated 2 million people in the world living with a stoma. Management of a stoma was long seen as the most decisive factor which led to many people opting out of having one, but more recently this factor has been negated due to various advancements made in stoma care such that an entire specialty – 'The EnterostomalTherapy unit' was born to tackle the issues arising from post stomal care. As a result we now see many people, even sportsmen with a stoma leading a normal life. Many advances in stomasurgery, Enterostomal therapy, and ostomy management systems are responsible forthe full lives that these ostomates live and stomas are now a barely noticeable alternative to anal defecation.

Even though the earliest description of a stoma was made nearly 200 years ago, these were not constructed by surgeons, but by forces of nature. They were said to have been created naturally when a part of bowel loop which had undergone strangulation, adhered to and opened on the surface of the abdominal wall. These fortunate individuals were said to have lived a life time with an enterocutaneous fistula. The Bible describes one of the earliestaccounts of visceral injury in the Old Testament when Eglon was stabbed by Ethud :*"He [Eglon] could not draw the dagger out of his belly and dirt came out"*. Patients

often managed these stomas on their own with makeshift appliances, rarelywith the help of physicians. It was not until much later that physicians pondered thesurgical creation of an ostomy. Some of the fascinating historical events associated with a stoma arediscussed below.

In 1710 Alexis Littre suggested the creation of an abdominal stoma for the treatment of imperforate anus after observations made during the autopsy of a 6-day-old infant. This event was reported by Fontanel, the historian to the Royal Academy of Sciences in Paris. Littre's idea remained untested for 66 years, until Pillore, a country surgeon from Rouen, France performed a cecostomy for the treatment of an obstructing rectal cancer.In 1757 Lorenz Heister firstrecommended the surgical creation of stomas for the treatment of abdominal trauma.Heister was resoundingly criticized by his colleagues based onthe inconvenience of exteriorized intestine. This was at atime when surgeons such as John Bell and Gene Palfin advocated closing the abdominal wound while leaving the injured intestines alone as the preferred treatmentfor penetrating intestinal trauma.

Exteriorization, however grew more popularthroughout the eighteenth century. Begny, Schafer, and Francois de la Peyronie all used this technique in the treatment of abdominal wounds. In 1783 Benjamin Bell modified the exteriorization procedure by creating a double-barreled ostomy in order to prevent stomal stenosis.In 1783 Dubois, a Parisian surgeon, performed an iliac colostomy on a 3-day-old child suffering from imperforate anus. Dubois was

successful in relieving the obstructionbut not in curing the patient. This child died on the 10th day following surgery. Thecolostomy had its true beginning with the surgery of Duret, a naval surgeon at theMilitary and Marine Hospital at Brest. In 1793Duret performed the first successfulleft iliac colostomy in the treatment of imperforate anus in a 3-day-old infant.

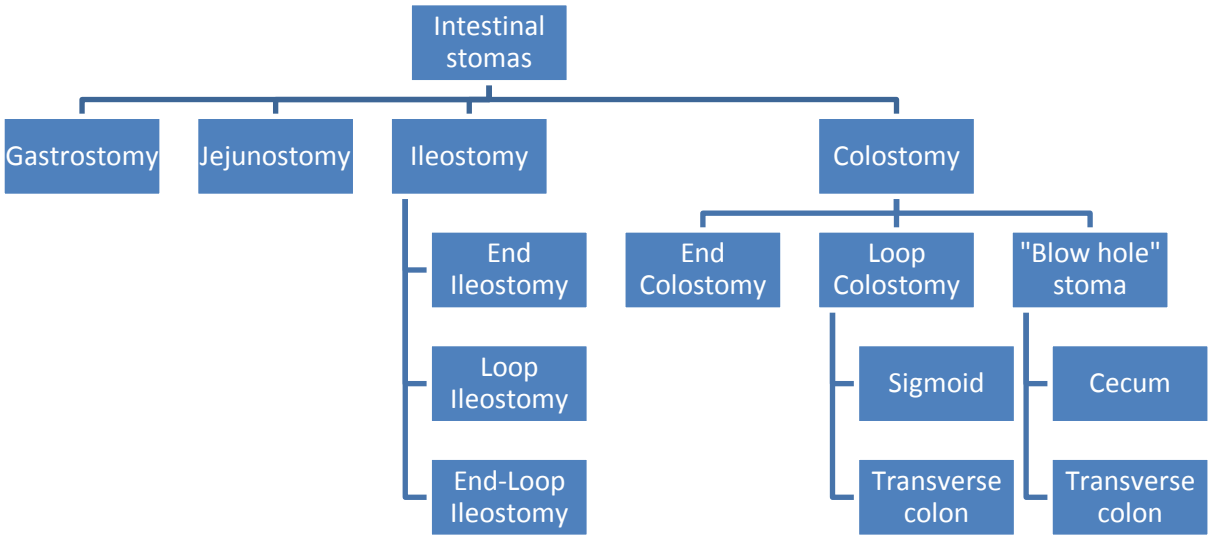
In 1797 Professor Fine, surgeon-in-chief to the Hospital in Geneva, performed the firsttransverse loop colostomy in a 63-year-old woman suffering from rectal cancer[1].Through a midline incision, he drew out an inflamed loop of bowel, passed a stitchthrough its mesentery and sewed it to the skin. The patient's obstruction was relievedand she lived another 3 months. Fine believed that he had created an artificial anusfrom the terminal ileum; however, autopsy revealed a successful transverse colostomy.With the advent of colostomies, it became necessary to create a means for thecollection of feces. The first mention of such a collecting device was reportedbyDaguesceau in 1795. He performed an inguinal colostomy in a farmer who impaledhimself on a cart stake while unloading wheat. Daguesceau also performed the first colostomy for the treatment of intractable perianalfistulas. Later SchitzingerandMadelung described a procedure of creating a proximal "singlebarreled" stoma while returning the distal closed loop to the abdominal cavity. F.T.Paul also advocated complete transection of the bowel in order to adequatelydefunctionalize the distal colorectum and this representedthe beginning of the end colostomy[2].

Although the history of colostomy dates back to the early 1700s, the ileostomy was first created by Baum in 1879, which was a diverting ileostomy for an obstructing right sided colon cancer. The first successful creation of an elective ileostomy was by Maydin 1883, who did it along with a colonic resection. Finney described an ileostomy for an appendicular abscess but severe cutaneous reactions resultedowing to a naïve technique, and theprocedure never gained any popularity. These initial stomas were created within the confines of the laparotomy incision itself and it was Rankin who advocated creating a stoma in a separate incision in the right lower quadrant.

In the 1950's Bryan Brooke of theUniversity of Birmingham in London described the now famous Brooke ileostomy.In 1952 Brooke described the ileostomy that remains in use today. One sentence, "A moresimple device is to evaginate the ileal end at the time of operation and suture themucosa to the skin; no complications have occurred from this", accompanied by asingle illustration, changed the ileostomy from a chronically inflamed and ulcerativestoma, frequently associated with dysfunction, to the functional "rosebud" we knowtoday[3].

CLASSIFICATION OF INTESTINAL STOMAS

Figure 1: Classification of intestinal stomas



Gastrostomy: Exteriorizing a part of the stomach for feeding purposes in malignancies in esophagus.

Jejunostomy: Exteriorizing a part of the jejunum eg: in surgeries for perforation wherein primary repair is not feasible, and for nutritional purposes.

Ileostomy: Exteriorizing a part of the ileum eg: in surgeries for obstructed CA cecum or ascending colon where primary repair is not feasible, in perforations involving the ileum, in complicated ileocecal tuberculosis etc

Colostomy: Exteriorizing a part of the large bowel eg: in surgeries for malignancy, perforation, inflammatory bowel diseases etc.

COLOSTOMY

A colostomy is most commonly constructed for a rectal cancer and is usually placed in the anterior abdominal wall. Constructing a stoma in the perineum would be disastrous as evidenced by surgeons in the 19thcentury, as it has no sphincter control and an appliance of any sorts is difficult to place in the perineum without soiling the adjacent area. In fact, in an elderly patient with poor sphincter control, a distal colorectal anastomosis would serve as a "perineal colostomy". Thus the construction of a stoma may be a better option for a surgeon and the patient rather than restoring the intestinal continuity to an incontinent anus. Colostomies can be classified according to their anatomic location or by their function.

Classification by anatomical location

Figure 2:Classification of colostomy by anatomical location

Proximal colon	Mid colon	Distal colon
• Cecostomy -Tube type • Cecostomy -Blow Hole type	• Transverse Colostomy - Blow Hole type • Transverse Colostomy - Loop type	• Sigmoid Colostomy - End and Loop type • Descending Colostomy - End type

End colostomies can be constructed in the descending or the sigmoid colon according to the viability of the inferior mesenteric artery on whose presence the sigmoid colon relies for vascularity. The left side of the colon

merely serves as a conduit and has very few mass peristaltic movements per day whereas the more proximal colon is associated with absorption of water, electrolytes and has more regular and frequent peristaltic contractions. Thus a stoma constructed more proximally on the right side of the colon would have a liquid, foul- smelling high volume output and in essence it combines the worst of an ileostomy and a colostomy, thus should be avoided as against a stoma on the left colon which is more solid and has a less frequent, regulated output.

Transverse colostomies are usually constructed on a temporary basis for decompression of the large bowel in a case of a distally obstructing lesion, or for fecal diversion that is needed to protect a more distal anastomosis. Cecostomies, though rarely performed these days are used in emergency conditions for decompression of an obstructed proximal large bowel in an otherwise old, frail patient with multiple comorbid factors that prevent a major resection.

Classification by function

The intended function of a stoma is more important than the anatomical site wherein it is fashioned. The Colostomy is intended to serve either of the two purposes:

1. To decompress the large bowel (Decompressing Colostomy)
2. To divert its contents (Diversion Colostomy)

Hence, while a stoma is fashioned both its anatomical location and its intended purpose should be kept in mind and a prospective site and type of stoma is chosen by evaluating the patient meticulously.

Preoperative considerations:

The method of choosing the site to construct a stoma is common for all types of intestinal stomas and is mentioned here.Many patients are unsure as to what an ileostomy or colostomy is. Hence, imparting adequate knowledge and obtaining prior consent takes top priority. If an EnterostomalTherapist(ET) is available, then the patient must be counseled by the ET, who can provide specific information regarding the stomal appliances, dietary and clothing alterations and pouch management. Most importantly the ET will select the most appropriate site on the abdominal wall for stoma which will decrease post operative complications and improve the ostomates' well being[4].

The patient must be fully evaluated in sitting, standing and in supine positions. Abdominal skin and fat folds are more obvious with the patient in sitting position. Three abdominal wall landmarks outline the ostomytriangle : the anterior superior iliac spine, pubic tubercle and the umbilicus. The stoma should lie within this triangle overlying the rectus muscle, generally at the site of an infraumbilical bulge in the abdominal wall. A site should be located on a flat segment of the abdominal wall 5 cm away from bony prominences, the umbilicus, prior surgical scars or skin folds. The site is selected and marked by applying a stoma face plate to the abdominal wall with its medial margin at the

midline and the exact site of stoma is marked. The patient should sit up to ensure that the skin folds do not interfere with the stomal site and the patients' belt line should be identified and avoided if possible as this decreases postoperative clothing restrictions. Despite any restrictions, the stoma must necessarily pass through the rectus to minimize the risk of post operative prolapsed or hernia.

In the distal colon, if an end colostomy (sigmoid or descending) or a loop colostomy (sigmoid) is contemplated, the most desirable position is usually in the left lower quadrant of abdomen. However, in obese patients, so as to not trap the stoma on the under-surface of a panniculus, it is desirable to site the colostomy in the left upper quadrant and hence making it more visible to the patient. For similar reasons, a distal transverse colostomy is fashioned more commonly over the left upper quadrant.Cecostomies are usually done in acute emergency settings and are usually placed on the skin right above the bowel wall. Ileostomies (end and loop) are usually created in the right lower quadrant.

Decompressing Colostomy

These stomas are most commonly constructed for distal obstructing lesions of colon with massive dilation more proximally without necrosis of the bowel and also for severe sigmoid diverticulitis and for toxic megacolon. These stomas serve to merely decompress the bowel and thereby prevent ischemic necrosis and perforation while acting as a bridge to definitive surgery for toxic patients with benign disease and those with malignant bowel

obstruction.Decompressing colostomy however does not necessarily divert the contents and as a result, it carries the risk of potentially fatal sepsis if there is distal perforation.

Types of Decompressing Colostomy

They are of three types:

1. “Blow hole” decompressing stoma in cecum or transverse colon
2. Tube cecostomy
3. Transverse-loop colostomy

“Blow hole” - Cecostomy and Transverse Colostomy

Cecostomyis reserved for severely ill patients with massive distention and impending perforation of colon which is most often seen in malignant obstruction or Pseudo-obstruction syndromes in elderly and immuno-compromised patients[5].The location of the stoma is usually right above the most distended part ofcecum which is to be decompressed.

Technique:

The technique of a “blow-hole” cecostomy and a transverse colostomy is essentially the same.

1. Incision is made over the skin of approximately 4 to 6cms immediately overlying the most dilated segment of the cecum or transverse colon as evident in a plain X-ray film. The incision is deepened and the peritoneal cavity is entered.

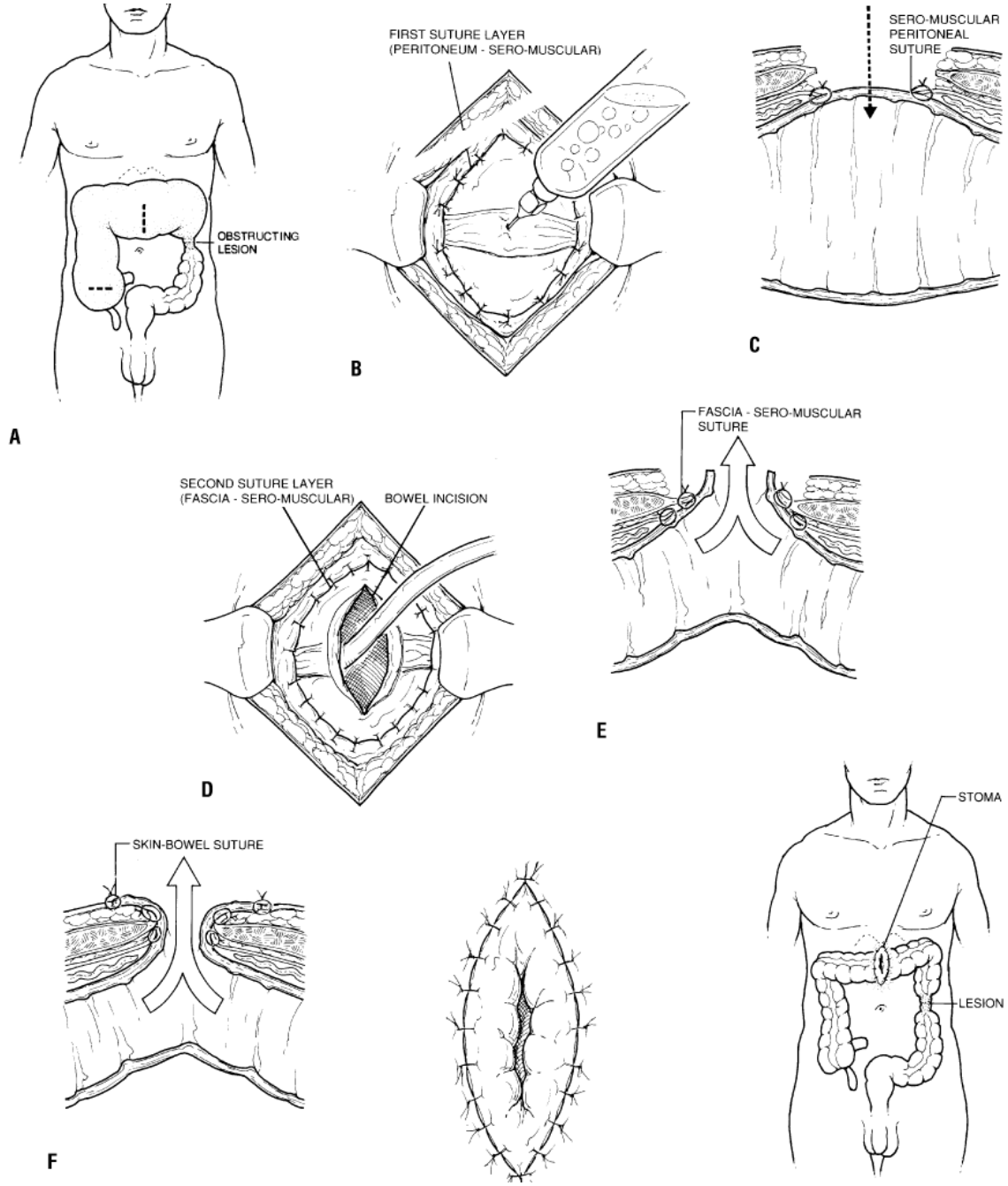
2. A first layer of interrupted, seromuscular, absorbable sutures is placed between the peritoneum and the seromuscular layer of the bowel to be decompressed. The skin incision made as above should be sufficient enough to allow a subsequent incision on the large bowel and suturing of the large bowel to the skin.
3. Needle decompression of the gas-distended viscus is performed to reduce the tension on bowel wall and subsequently a second layer of absorbable suture is placed between the seromuscular layer of the intestine and the fascia of the abdominal wall.
4. The colon is incised, usually with release of large amount of liquid and gas. The full thickness of intestine is then sutured to the full thickness of skin, again with absorbable sutures, and an appliance is placed over the stoma.

Disadvantages:

1. Since this is done through a small incision, one cannot evaluate other parts of the colon for potential ischemic necrosis.
2. Significant inflammation is usually noted in the abdominal wall around the stoma.
3. Stomal prolapse is commonly seen with this technique.

These stomas are difficult to manage post-operatively and hence they must be rarely constructed and used only for short period of time with definitive resection performed as soon as possible.

Figure 3 : The technique of constructing a "Blow- Hole" type stoma



Tube cecostomy

A Tube Cecostomy is also a decompressing stoma whose indication and usage has decreased in the recent past due to its poor function and increased post-operative complications[6].

Technique:

This is constructed by either approaching the cecum through a laparotomy incision or by making an incision in the abdominal wall over the distended cecum.A purse string suture is placed in cecal wall and a 1 cm incision is made over the dilated cecum and a large mushroom-tipped or Malecot catheter is introduced in the cecum. The purse string is then tightened to secure the catheter.A second purse string suture is placed and the tube is brought out through the skin incision in the right lower quadrant. TheCecum is sutured to peritoneum.

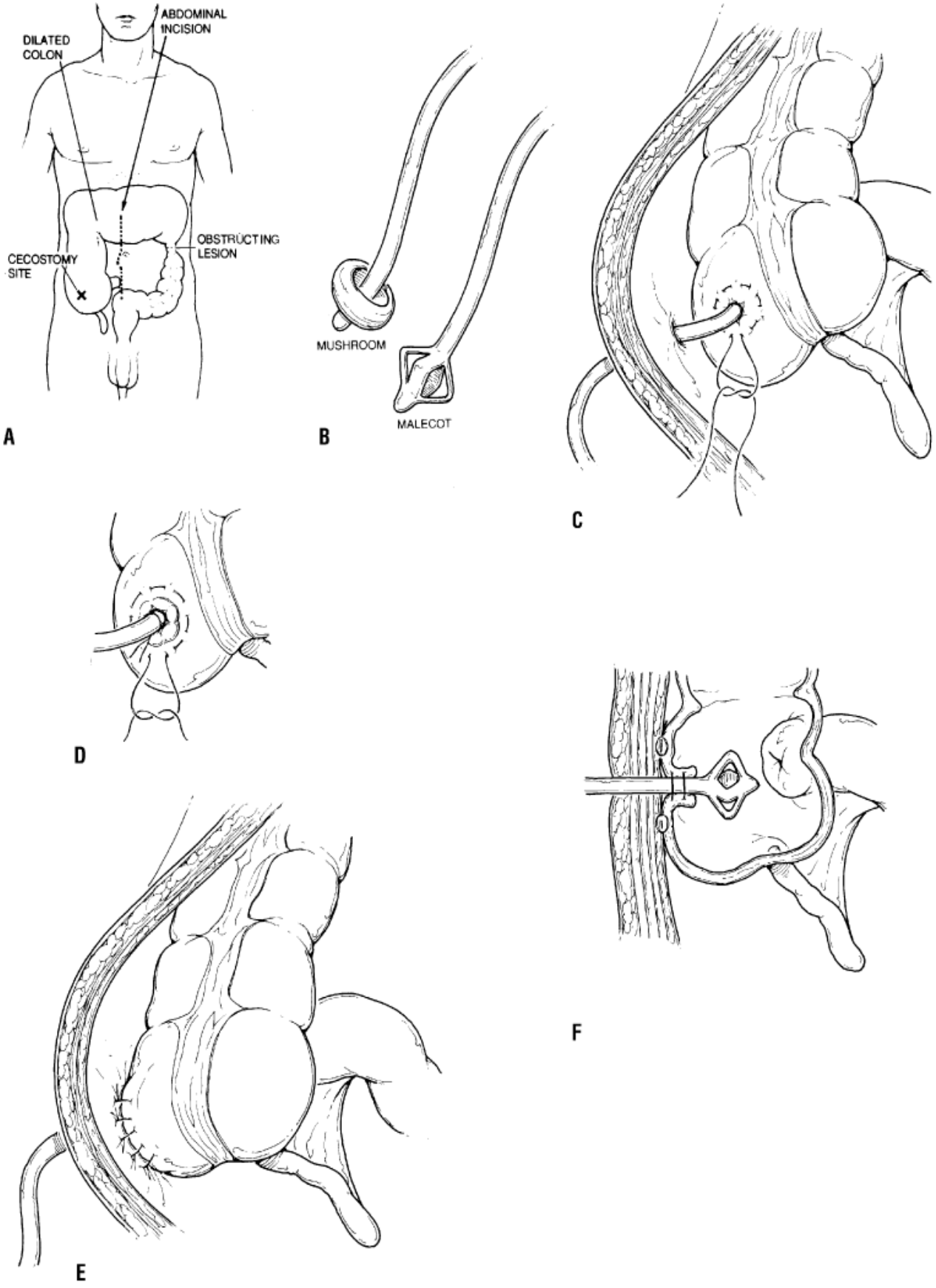
Advantages:

1. This can be performed quickly and hence useful in emergent settings.
2. Less chance of prolapse

Disadvantages:

1. Tubes usually become blocked with feces, drain poorly and leakage is often noticed adjacent to the drain resulting in poor functional outcome.
2. Post-operative care is difficult.

Figure 4 : The technique of constructing a tube type cecostomy



Transverse Loop Colostomy

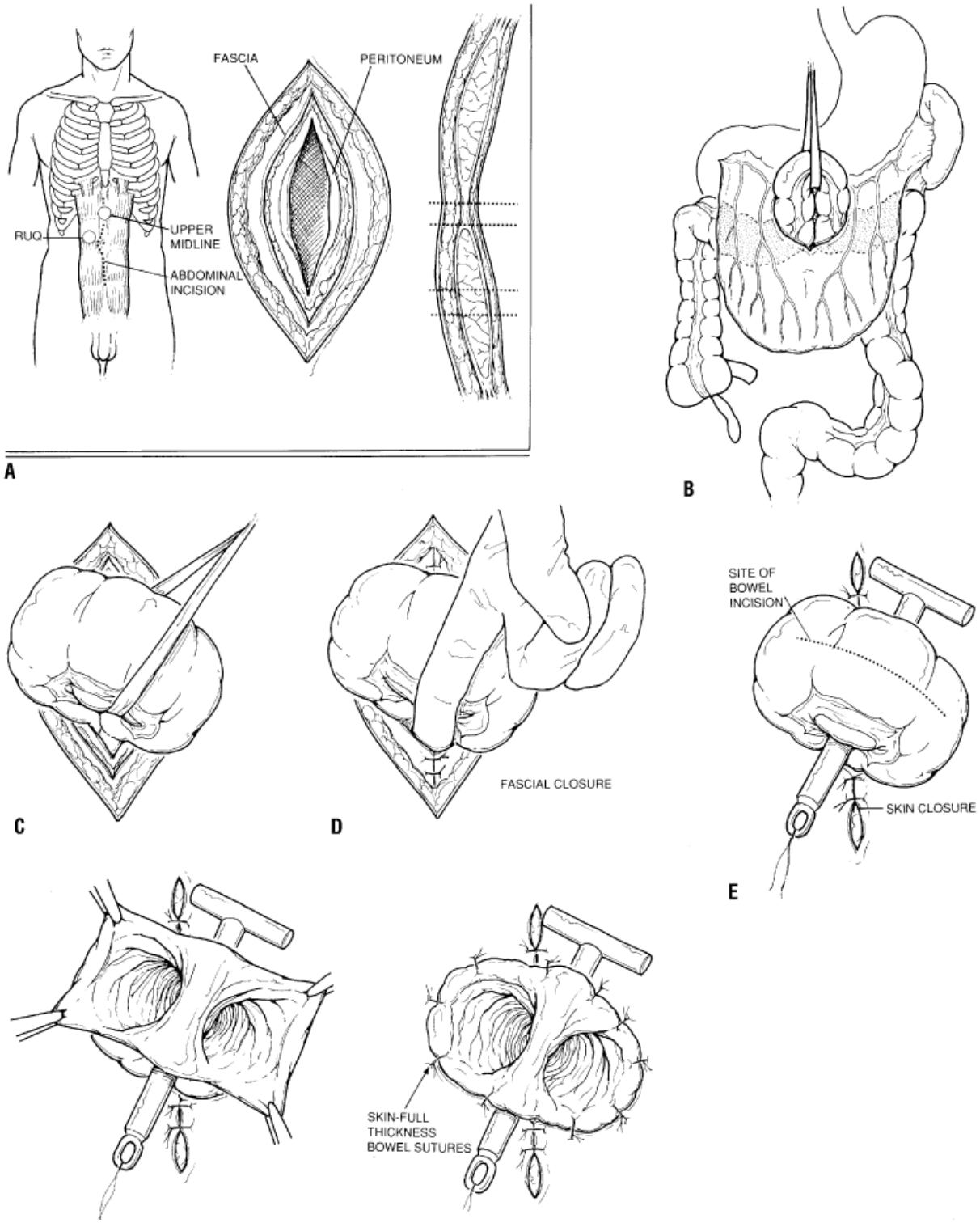
These stomas are constructed to provide decompression of an obstructed colon and they also provide temporary diversion for protection of complicated distal anastomosis. When properly constructed, these can also serve as long term stomas. However in many instances an end loop stoma may serve to function better than a standard loop colostomy[9]. Prolapse and Para-stomal hernias do occur although their incidence is related to the technique of the surgeon.

Technique:

1. The site of the stoma is chosen and marked on the abdominal wall. In elective situation, the stoma can be placed through the rectus muscle either on the right or the left side or it can be brought out through the mid-line.
2. The mesentery and overlying omentumof the transverse colon is dissected free and a tracheostomy tape is placed around the colon at the site chosen for colostomy. The distal end of the bowel is marked with a suture which will prevent maturation of the incorrect segment and the tracheostomy tape and colon are mobilized and brought out through the laparotomy wound without twisting.
3. The fascia is then vertically closed on either side of the loop of colon tightly enough to permit snug passage of one finger tip. The skin is then closed also snuggly, on either side of the loop of the colon.

4. The protruding loop of colon is incised over its distal end comprising 80% of its circumference from mesentery to mesentery. The distal end is then “matured”. This is achieved by using the “tripartite” bites which involve the full thickness edge of the bowel wall, the seromuscular layer at the fascial level and the dermis. The sutures are all held together with a pair of forceps and are tied together which will allow the stoma to evert nicely.
5. A properly constructed stoma will present a bulging posterior wall providing the desired diversion as well as decompression. The tracheostomy tape is replaced by an appliance like a T-shaped plastic rod. Patients are instructed to empty the appliance as and when required. Post-operative management is easy and hence these stomas are frequently constructed.

Figure 5 : The technique of constructing a loop transverse colostomy



Closure of a temporary colostomy:

Before closure of a stoma, the following points must be considered and evaluated endoscopically and by contrast studies.

1. Is it safe to restore the intestinal continuity?
2. Is the integrity of distal bowel adequate?
3. Is the sphincter function distally adequate?

The adequacy of anal sphincter can be demonstrated by formal manometric and electro myographic studies or by simply giving the patient a 500 ml enema and asking him or her to hold until he or she can comfortably walk to the toilet and expel the enema.

Technique:

1. A circumferential incision is made around the stoma including a small rim of skin. The incision is deepened and peritoneal cavity is entered and the colon and the surrounding omentum are separated from the abdominal wall. The fibro-fatty tissue and omentum are resected from the serosalsurface. The stoma can then be closed either by a hand-sewn technique or by using a stapling device. If there is doubt regarding the integrity of the bowel wall, resection of the bowel and a formal end to end anastomosis is done. The skin is then closed.

Diverting colostomy:

This is primarily constructed to provide diversion of intestinal content. It is performed when the distal segment of bowel has been completely resected, when there is a known or suspected perforation or obstruction of the distal bowel or when there is destruction or infection of the distal bowel. End colostomy and a loop transverse or sigmoid colostomy can act as a diverting colostomy.

Indications:

1. Abdomino-perenial resection
2. Diverticulitis
3. Anastomotic leakage
4. Trauma
5. Crohn's disease
6. Complex anal sphincter reconstruction

A completely diverting colostomy can be made only with complete transaction of the colon as is done in the case of an end colostomy. However, a properly constructed loop - transverse or sigmoid colostomy can provide near complete diversion as well. The principle behind a diverting colostomy is the fact that the stomal appliance is at atmospheric pressure which is lower than the pressure within the bowel and hence the contents of the bowel would preferentially move into the stomal appliance. If, however, a transverse or a

sigmoid loop colostomy is employed for diversion, the distal bowel is still in partial continuity and hence when the stomal appliance is full, its contents could be forced into the distal bowel owing to pressure gradient. This phenomenon does not occur in an end colostomy, but it is critical in an end colostomy that the distal limb of the bowel should be vented to the atmosphere as a mucus fistula and not closed, whenever there is a distal obstructing lesion. If the distal limb is closed, there is a risk of closed loop obstruction and subsequent perforation. The decision on whether to close the distal stump or to fashion a mucus fistula depends on the length and the integrity of the distal segment. For example, in a patient undergoing sigmoid colectomy and colostomy for complicated diverticulitis, it is reasonable to close the rectal stump. However, in a patient undergoing abdominal colectomy and ileostomy for toxic colitis, it is preferable to bring the distal segment as a mucus fistula to avoid rectal stump blowout. Mucus fistula can be constructed through a separate opening or it can be fashioned in the same incision that is used to construct the proximal stoma. The construction of a loop sigmoid colostomy is done in the same manner as that of a loop transverse colostomy described above and hence the technique of constructing an end colostomy is alone mentioned below.

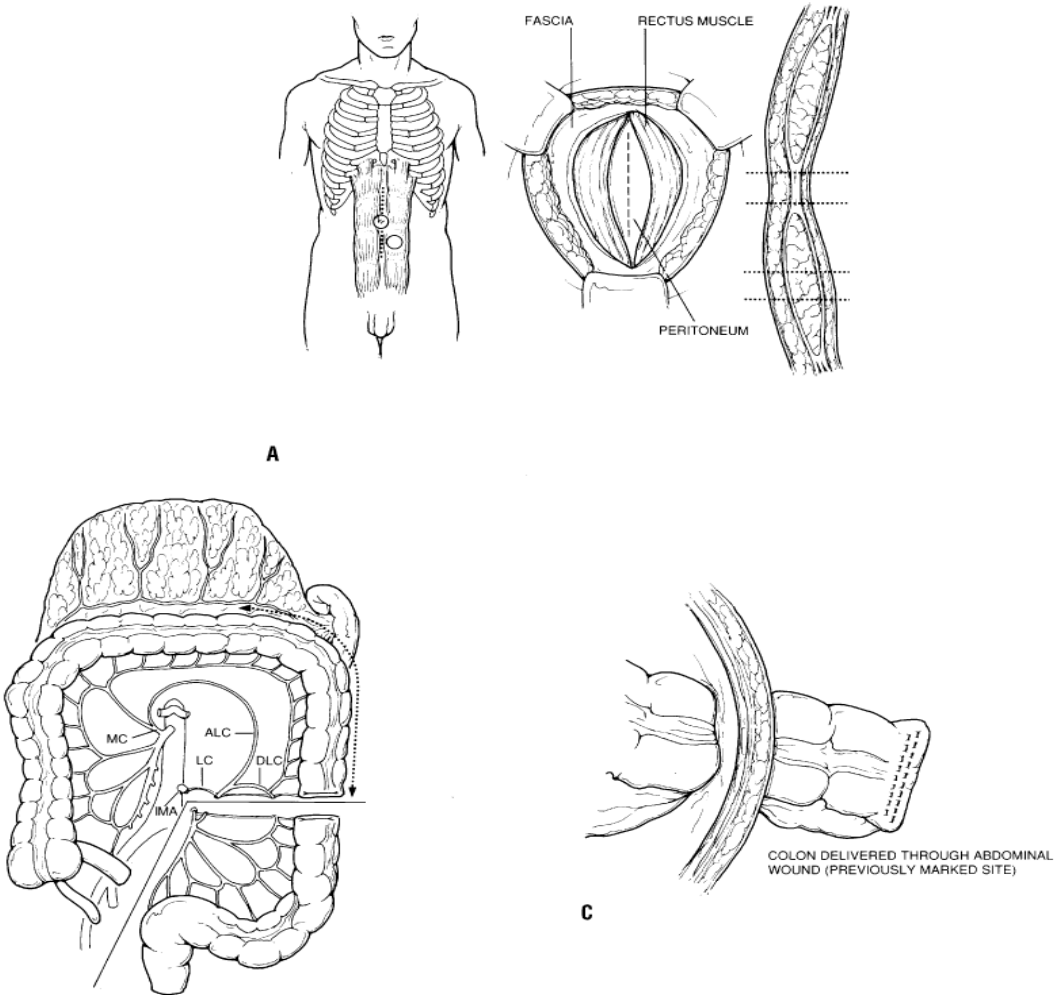
Technique:

1. An end colostomy is usually located in the left lower quadrant, site being chosen in the manner described above.

2. An end colostomy requires mobilization of the entire left colon along with the splenic flexure. If there are concerns regarding viability of sigmoid colon, a descending colostomy is done.
3. An opening in the abdominal wall is made by excising a 3-5 cm disc of skin sparing the subcutaneous fat, as this aids in supporting the stoma in the postoperative period.
4. The fat is then separated with scissors and cautery to expose the anterior rectus sheath. The sheath is incised vertically for 3 to 4 cm. The incision can then be extended in a cruciate fashion laterally for upto 1cm if desired. Medial extension is avoided as it brings the stoma closer to the midline and would make closure of the midline wound more difficult.
5. The rectus abdominis is split in the direction of its fibers to expose the posterior sheath. With the non dominant hand protecting the underlying viscera, the posterior sheath is bluntly opened with the scissors and the defect is enlarged to admit two fingers.
6. After adequate mobilization of the colon, it is oriented without twisting and is brought through the skin wound created as above. The colon should protrude beyond the skin and appear well perfused. The adjoining proximal colon can be sutured to the abdominal wall and the rectus sheath defect can be closed snuggly both of which will theoretically reduce the risk of prolapse and parastomal hernia. The abdominal incision is then protected by a drape or gauze.

7. The stoma is then matured by using “tripartite” bites as described above. Colostomies may be sutured without eversion also as distal colonic contents are not irritating to the surrounding skin. Skinis closed and the stoma appliance is fitted.

Figure 6 : The technique of constructing an end colostomy



LONG-TERM COLOSTOMY MANAGEMENT

1. Enterostomal therapy(ET)

The enterostomal therapists contribute a lot to the overall success of a stoma in a patient. They not only provide preoperative counseling and post operative guidance, but also act as a long-term resource for individuals with stomas. They supply valuable information regarding appliance choices, suggest dietary or clothing modifications and aid in the management of complications such as skin necrosis, parastomal hernia, stomal prolapse etc. however if this support system is unavailable, then it is the surgeons' responsibility to educate the patient in the long term management of the stoma. A stomal appliance has a few components namely,

- A skin barrier
- An adhesive disk
- A face plate
- A drainable pouch

Most ileostomy appliances are now available as a disposable single piece or semi-disposable two piece units. A commonly used appliance has a skin barrier with a plastic ring which enables to precisely cut a stomal opening to apply the skin barrier and to snap the pouch directly on to the plastic ring and hence allowing easy drainage and disposal of the pouch. The skin barrier component needs changing only every 4 or 5 days in a patient with an otherwise

properly constructed stoma. A well-balanced diet, normal physical figure, ability to engage in normal recreational and sexual activity is all possible with a well-constructed colostomy.

The appliance must be emptied frequently to avoid overfilling and dislodgement of the pouch. This is usually determined by the location of the stoma and the patient's natural bowel gas pattern. Colostomies usually empty only once or twice a day or even once every other day. The entire appliance needs to be changed only every 4-7 days. The technique for changing an appliance is described below

1. The soiled pouch is removed by pushing down on skin while lifting up on pouch. Soiled pouch is discarded in an odor proof bag.
2. The stomal and peristomal skin is cleaned with a moist cloth and patted dry. In a *cut to fit* pouch, the stomal opening is cut to match the exact size of the stoma and the skin barrier paste is applied to the stoma and it is pressed into place.

Pouch should be ideally changed when the stoma is least active, which is after a period of fasting. This avoids the need to control fresh output during the procedure. The noise and odor of gas emitted from a stoma are a major concern to most ostomates. Anything that causes gas before creation of the stoma is likely to create gas following its construction. Gas comes from two sources: swallowed air and bacterial breakdown of ingested foodstuffs, particularly

carbohydrates. The amount of swallowed air can be minimized by avoiding the use of straws, excessive talking while eating, chewing gum, and smoking. Each individual can best identify which foods lead to gas production, but beans, broccoli, onions, Brussels sprouts, beer, and dairy products in lactose deficient individuals are common culprits. Avoiding these foods is a personal choice but will decrease the quantity and odor of stomal flatus. Yogurt, parsley, and orange juice have been associated with decreased odor. Odor-proof pouches, charcoal filters, and pouch deodorants (e.g., commercial deodorants, mouthwash, and perineal deodorants) may also help. Orally ingested deodorants are also available and include bismuth subgallate and chlorophyllin complex. However, the most important key to preventing odor is good peristomal hygiene and creating a leak-proof seal at the time of appliance change.

A period of adjustment occurs in all ostomates, but attention to detail at the time of appliance change combined with minor dietary and clothing modifications should make a stoma completely unnoticeable to all except the ostomate's closest acquaintances. In addition, abdominal stomas should not preclude participation in almost any physical activity.

Irrigation

Proper colostomy management is essential in the long term acceptance and maintenance of a stoma. Irrigation of a stoma is the most important practice that any patient should develop in order to regulate a stomal flow and hence to

improve the quality of life. Irrigation tends to clear the proximal bowel of its contents and temporarily eliminates the need for a stomal appliance, although most patients tend to keep an appliance fitted to permit flow of mucus and de odorized gas in between two bowel movements.

Principle :

The large bowel exhibits one or two mass movements per day and these can be stimulated by distention of the colon, which in turn is accomplished by irrigation. Hence irrigating the bowel tends to reduce the bowel movements to 1-2 per day. However in patients with irritable bowel syndrome this regulated bowel movement cannot be accomplished.

Technique :

The patient is instructed to feel for the stomal opening with a finger and advised to instill 500-1000 ml of water into the proximal loop. This would initiate mass peristalsis and tends to evacuate the bowel of its contents. The patient can then proceed with regular activity and once the bowel is cleared, the patient can even carry on without the need for a stomal appliance.

Advantages

1. Appliance need not be worn at all times.
2. Life style could be more regulated.
3. Passage of uncontrolled gas can be regulated.
4. less leakage of stool between irrigations
5. General feeling of comfort after irrigating a stoma.

Disadvantages

1. it is a time-consuming ritual and some people feel discomfort when the bowel is distended during irrigation
2. Irrigation carries a minimal risk of perforation
3. Absorption of water during the irrigation process can be significant, and the patient with an irritable bowel syndrome will usually not achieve adequate control by irrigation and may be frustrated by attempting to do so

Complications of a colostomy

One of the commonest problems faced by a patient with a stoma is irregularity in bowel movements which is more often related to a prior history of irritable bowel syndrome. Other common causes of improper bowel movements would include diarrhea and constipation which may be related to the patientsunderlyingdiseaseprocess or any infections. Uncontrolled passage of gas is common as the stoma does not have a sphincter, which can be managed by adjusting the dietary habits. Another important complication would include skin disorders which include a simple irritant dermatitis to severe eczema which is attributed to the toxic effluent from the stoma. Minimal bleeding around a stoma is common because the mucosa is exposed to environmental trauma. Of course, prolonged bleeding should be evaluated to be sure that there is not a

recurrence of the primary disease process. More rare causes would include stomal prolapse and parastomal hernia.

Stoma Stricture

Stomal stricture can be attributed to ischemia or serositis of the bowel wall. Ischemia often arises as a result of too much division of the mesentery, while serenities, not seen commonly these days was attributed to delayed opening of the colonic lumen. Both can lead to stricture and can be prevented by "maturing" the stoma, which essentially means suturing the full thickness of the stoma to the skin. If, however a stricture has indeed developed, then it can be reversed by a simple procedure such as W- or Z- plastyunder local anesthesia. A larger stricture might however require a laparotomy. . Present incidence of stricture or stenosis has been reported to be around 10%[10.]

Parastomal hernia

It is probably the most common stoma complication that requires operative intervention. It develops in 4 to 48% of patients with an end colostomy[11,12]. The occurrence of these hernias increases with time. The principle behind formation of a parastomal hernia is the fact that the posterior rectus sheath is weak in the infra umbilical region and there is a potential for a peritonealized sac to herniated in between the layers of the rectus sheath and muscle during periods of increased intra abdominal pressures. Patient factors

such as obesity, advanced age and chronic obstructive pulmonary disease appear to increase the risk of parastomal herniation[13]. In contrast, technical issues such as lateral space closure, fascial fixation or stoma placement through the rectus muscle appear to have no effect on the incidence of these hernias. The use of prosthetic mesh prophylactically in the sublay position may reduce the risk of parastomal hernias[14,15].

Asymptomatic parastomal hernias should be observed, as there is a high chance of recurrence if operated. Patients should be advised to report to a surgeon once they develop signs and symptoms of bowel obstruction. Only symptomatic hernias should be operated and the choice of surgery is varied, including laparoscopic repair and an open repair with a mesh placed in the fascial layers. Unfortunately the results of surgical correction have been poor historically, and hence it is very important to select patients carefully. Surgical techniques include direct repair, mesh and stomal relocation. Recurrence rates associated with mesh repair appear to be much lower. Sugarbakers' technique of an underlay mesh repair has shown the best results and it could also be done laparoscopically[16]. The extra peritoneal mesh repair although a better alternative to individuals who are poor candidates for laparoscopy is undoubtedly associated with much higher recurrence rates.

Parastomal prolapse

Prolapse of a stomal segment is most often seen with a transverse loop colostomy and the efferent limb is almost virtually the offending agent[17]. The reasons for the same are :

1. Long mesentery of the transverse colon which is not fixed retroperitoneally.
2. Large fascial defect to include the stoma.
3. Procedure done in a dilated bowel, which after decompression would broaden the actual fascial defect required to fashion the stoma and hence making the defect more lax and more predisposed to a prolapse.

Though controversial, this is the reason a loop ileostomy is favored to a loop transverse colostomy while attempting to decompress or divert the bowel contents. Asymptomatic prolapse needs no treatment. When it causes ischemia, obstruction or pouching problems, surgical intervention is warranted. Ideal method to manage a prolapse is to deal with the primary disease for which a stoma was created, or to resect and re anastomose the stomal segment. If primary pathology cannot be dealt with as yet, it is better to convert the loop colostomy into an end colostomy.

Figure 7 : A rare occurrence of a stomal prolapse with a parastomal herniation

Colostomy perforation

This occurs under rare conditions in which the colon is irrigated excessively with water or a contrast material is injected in excess. Treatment requires an immediate laparotomy and closure of the perforation with recreation of the stoma.

Stomalvarices

These varices develop as a result of abnormal Porto systemic anastomosis that develops between the portal venous system of the bowel and the cutaneous veins at the level of the muco cutaneous junction of the stoma. The typical "caput medusa" of the peristomal skin is indicative, especially in a patient with chronic liver disease and these may present with life threatening hemorrhage.

Patients with short life expectancies (e.g., extensive liver metastases) may be treated by mucocutaneous disconnection; the stoma is freed up to the level of fascia, thereby dividing the port systemic connections. Since these anastomoses typically reform within 1 year, more definitive solutions are required in most patients. More durable options include surgical shunts, transjugular intrahepatic port systemic shunts, or liver transplantation, based on life expectancy and the status of the associated liver disease

Ischemia

Edema and venous congestion are common after stoma creation owing to mechanical trauma and compression of the small mesenteric venules as they traverse the abdominal wall. This is typically self-limiting and requires no treatment[18]. However, ischemia may be related to tension on the mesentery or excessive mesenteric division, particularly in obese patients or those undergoing emergency surgery. A common error is dividing the sigmoidal vessels to obtain the length to allow a colostomy to reach the skin. In these cases, the inferior mesenteric vessels should instead be divided proximally and/or the splenic flexure mobilized, preserving the sigmoid arcades.

If ischemia becomes apparent, a glass test tube or flexible endoscope may be inserted into the stoma. If the stoma is viable at fascial level, then the patient may be carefully observed. However, if there is question about the viability of

the stoma at fascial level, immediate laparotomy and stoma revision are required. Early ischemia is seen in 1% to 10% of colostomies.

ILEOSTOMY

An ileostomy refers to exteriorizing the ileum, more often distal than proximal, onto the abdominal wall. The stoma is constructed on a permanent basis for patients who require removal of the entire colon (and usually the rectum) and for inflammatory bowel disease. The use of a loop ileostomy is becoming more frequent because of the complex sphincter-preserving operations being performed for ulcerative colitis and familial polyposis. For these operations (restorative proctocolectomy), it is necessary to have complete diversion of intestinal flow while the pouches are allowed to heal and adapt. The loop ileostomy is also useful in cases where multiple and complex anastomoses must be performed distally, usually for Crohn's disease or rectal cancer. As sphincter-preserving operations are used more often, diminishing numbers of permanent ileostomies will be constructed, but equal number of temporary loop ileostomies will be constructed. The same principles used in constructing an ileostomy can be applied to the construction of a urinary conduit.

The surgical construction of an ileostomy must be more precise than that for a colostomy because the content is liquid, high volume, and corrosive to the

peristomal skin. Therefore, the stoma must be accurately located preoperatively, and it must have a spigot configuration to allow an appliance to seal effectively and precisely around the stoma.

Various types of ileostomies can be constructed. The most common has been the end ileostomy, using a technique popularized by Brooke and Turnbull. The loop ileostomy is used, as described, to protect diseased areas or surgical procedures distally. The end- loop ileostomy is a stoma that uses the principles of a loop ileostomy but is constructed as a permanent stoma when the mesentery and its blood supply need special protection. The continent ileostomy, a technique devised by the Swedish surgeon, Nils Kock, is an internal pouch that does not require the wearing of an external appliance. The urinary conduit is a stoma constructed of small intestine to provide a conduit to the outside for the urinary tract.

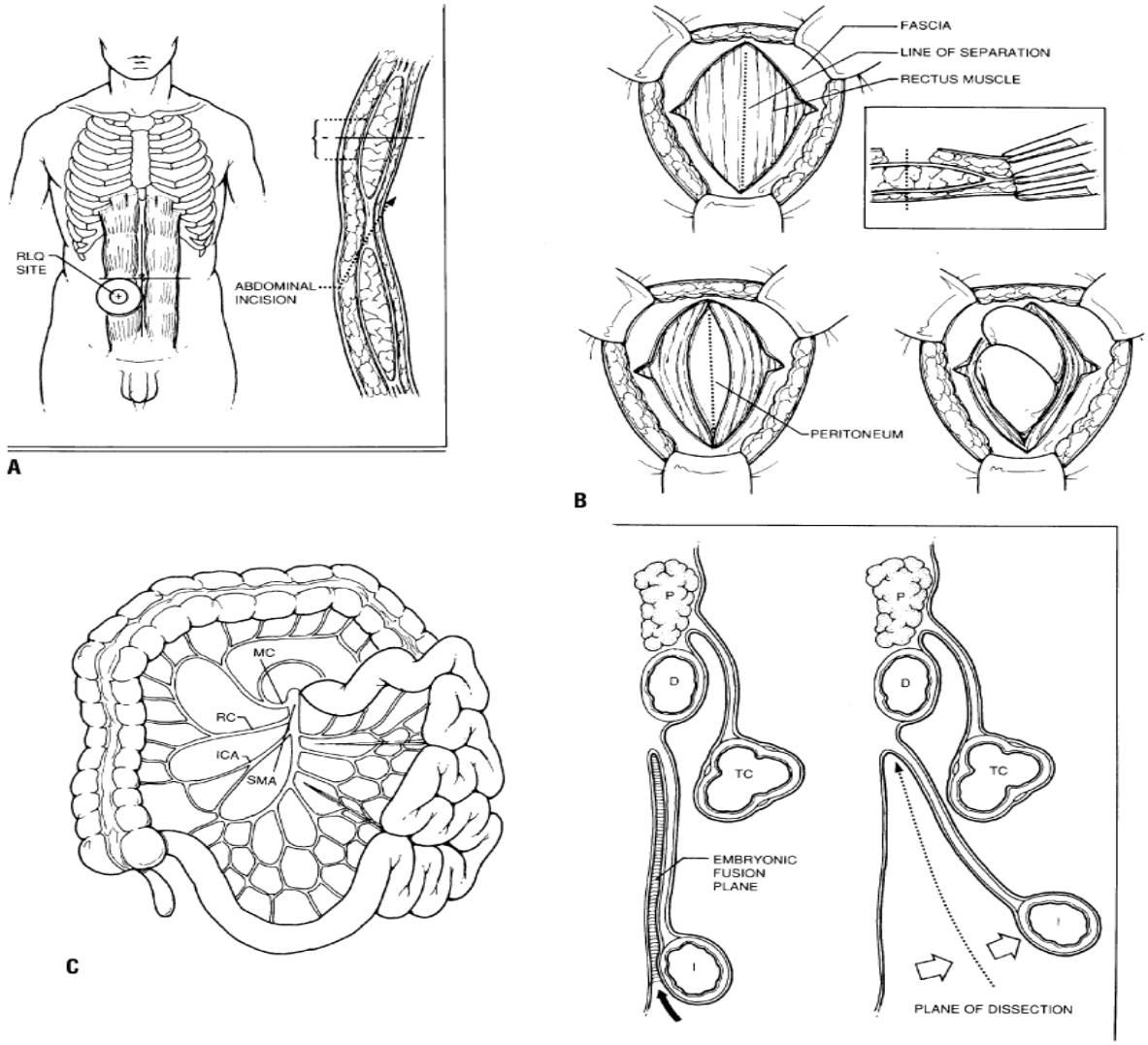
As in the case of a colostomy, choosing the exact site of an ileostomy is mandated pre-operatively and is done with the patient in sitting position and marking two lines one through the umbilicus vertically and the other through the inferior margin of the umbilicus, horizontally. The stoma must be placed such that it abuts on both lines at the right lower quadrant and doesn’t cross either. A circular disk, the site of a stoma faceplate, of about 8cm is used to mark the site of stoma. The patient is then put in an exaggerated sitting position and made sure that the location of the stoma is at the summit of an infra

umbilical fat fold and doesn't point upward or downward. A majority of stoma complications can be avoided by marking the site of a stoma precisely. The best incision for an end ileostomy is left paramedian, slanting to the midline fascia, which maintains opening the abdomen in the midline, yet places the skin incision away from the midline to aid in fixing a secure stomal appliance.

END ILEOSTOMY

The construction of an end ileostomy is carried out after full mobilization and dissection of the colon, and adequate mobilization of the terminal ileum. The ileum is suspended from the posterior abdominal wall by the mesentery and hence can be dissected free and fully mobilized in a plane corresponding to its embryonic fusion with the right posterior abdominal wall. The ileo colic artery is transected and the ileal segment corresponding to its blood supply is divided. The remaining ileum is prepared for an ileostomy by maintaining the most distal arcades along its mesenteric border. The preservation of arterial arcades ensures the viability of the ileum and even though the fat and mesentery may appear excessively bulky, the fat soon atrophies and leaves a fully vascularized ileal segment as a stoma. This step is made as early as possible during a laparotomy so that any question regarding the viability of the transected ileum can be answered long before the laparotomy is closed.

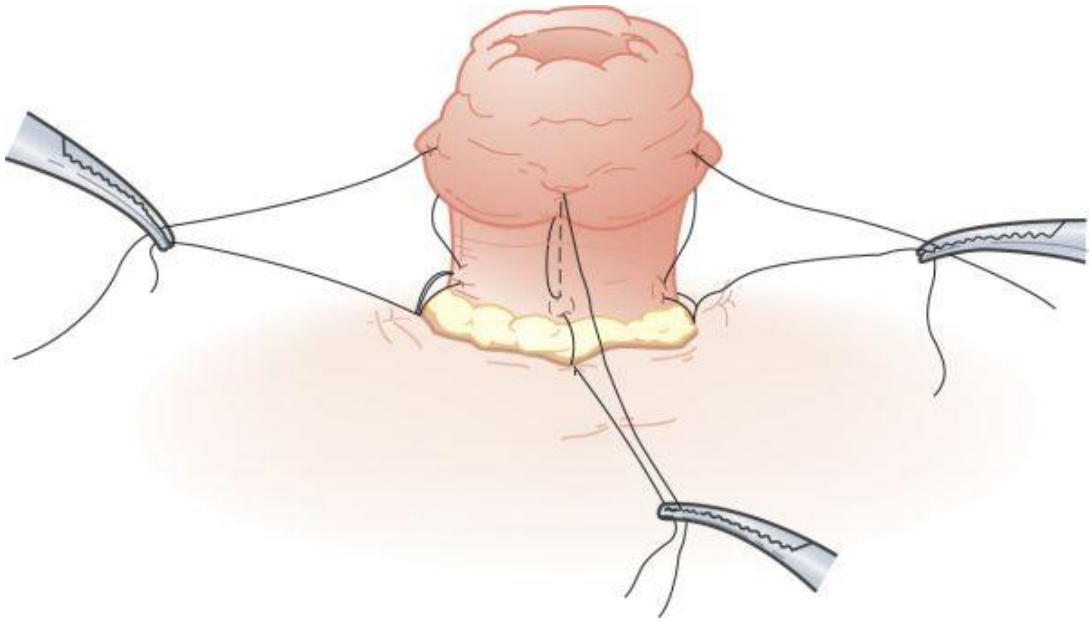
Figure 8 : The technique of constructing an end ileostomy



The stoma can be brought out by making a circular incision of diameter 3cm over the stomal site previously marked and dissecting the fat till the anterior rectus sheath is reached, which is opened in a cruciate manner, the rectus muscle is retracted and posterior rectus sheath and peritoneum are incised vertically. The ileal segment is brought to the exterior. Fashioning a stoma involves various techniques, each with its own success rates. The conventional technique is the 3 point fixation, using 3-0 chromic and bites are taken at full

thickness of the ileum, the seromuscular layer of ileum at the base of the stoma and then the dermis. Bites taken through the skin would result in stellate scarring of the stoma and hence should be avoided. Eight of these sutures should be taken, one in each quadrant and one in between each and they should be held in place and tied together so that the stoma everts nicely. This process known as "maturing the stoma" is important as it pours the ileal effluent directly into the stomal appliance and prevents soiling the skin around and hence prevents local sepsis and skin necrosis. A perfectly sized stomal appliance is fit around after cutting the skin barrier and it is held in place by using non irritant skin adhesives.

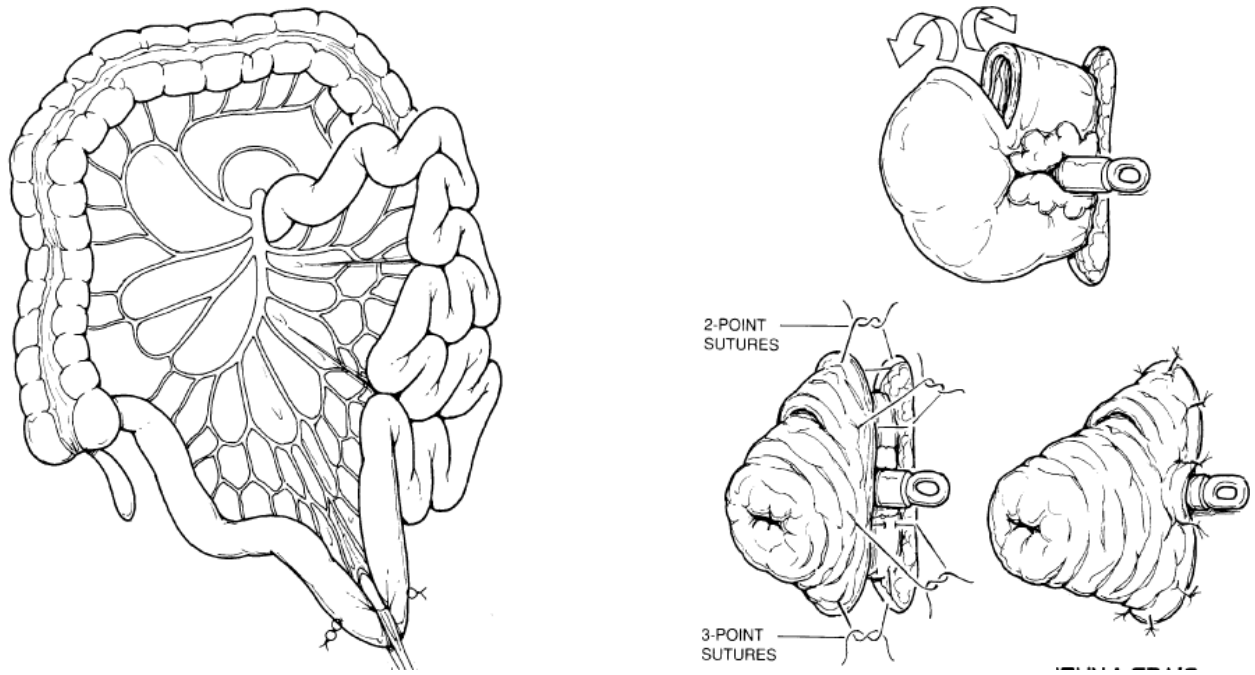
Figure 9: The "Tripartite" fixation



LOOP ILEOSTOMY

This is used when both decompression and diversion are both required. The skin site for the loop stoma is decided as above and the loop of ileum is internally hooked up using a Penrose drain or a tracheostomy tube by making a small rent in the mesentery. The proximal and distal ends of the ileum are marked internally and the ileum is then brought out externally so that the proximal loop is oriented superiorly. An incision is made over the ileum which encompasses four fifths the circumference of the ileum allowing the 1-cm rim of ileum above the skin level. The procedure is done in such a way that the recessive limb is formed distally and as in end ileostomy, a 3-point fixation involving the full thickness of ileum, the sero-muscular layer of the ileum and dermis is made over the proximal limb and a 2-point fixation involving the full thickness of ileum and dermis alone is made over the distal limb. As the sutures are tight, the stoma should assume a spigot configuration. An ileostomy appliance may be placed over the stoma. This technique described above is the classical Turnbulls' technique.

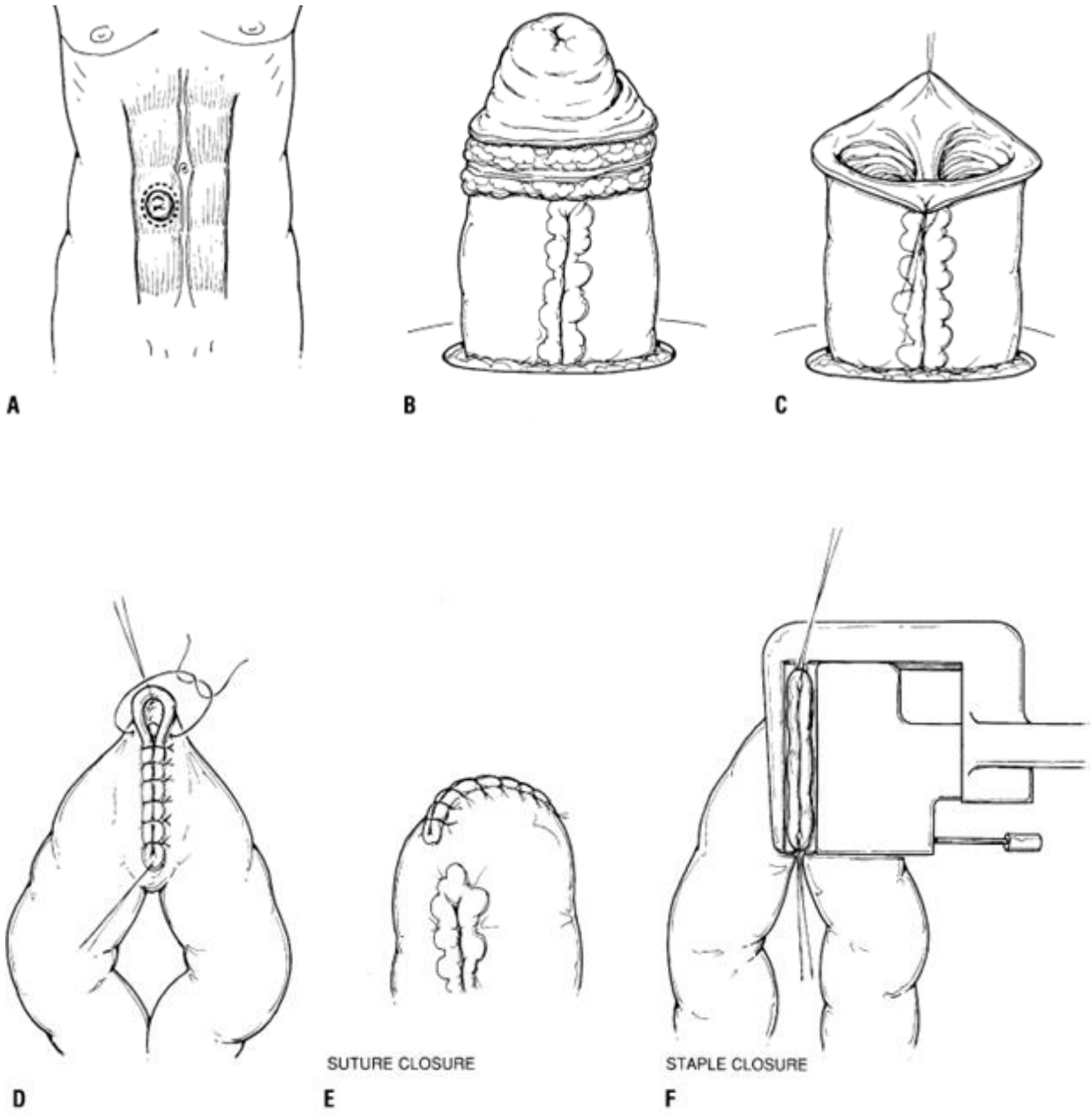
Figure 10: The TURNBULLS' Technique of Loop Ileostomy



Closure of loop ileostomy

Contrast studies are indicated to ensure that the distal anastomosis has healed securely and only then can consideration be given to close the loop ileostomy. Circumferential incision over the skin surrounding the ileostomy is made and further dissection is carried out until the peritoneal cavity is entered and the clean peritoneal surface should be palpable circumferentially. The loop of the intestine can now be brought out easily. After excising the rim of fibrous tissue, closure of the stoma can be carried out using hand sutured technique in two layers or a stapler closure.

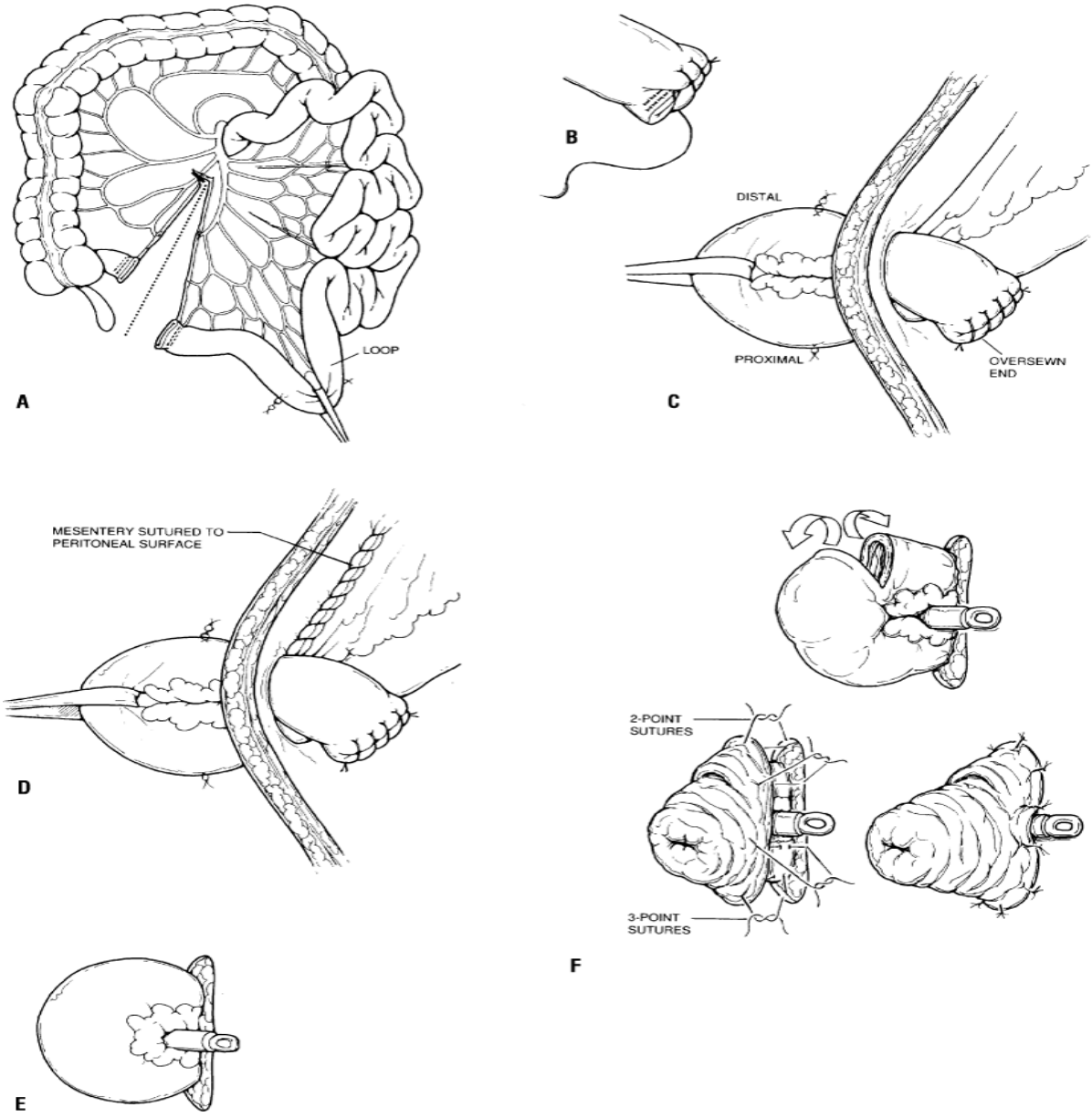
Figure 11: The technique of closure of a loop ileostomy



LOOP – END ILEOSTOMY

This should be constructed in rare circumstances which make it unsafe to resect the mesentery of distal ileum or when there is undue tension on the mesentery during construction of the ileostomy. This is exclusively seen in a very obese abdominal wall or patients with multiple surgical procedures which render the mesentery less mobile. Technically, a loop-end ileostomy is constructed by transecting the ileum but the transected end will remain closed. Orienting sutures are placed as described in the construction of a loop ileostomy and further technique remains the same. In this case, the stoma will be permanent and hence the mesentery of the distal ileum is fixed to abdominal wall. A complication of loop-end ileostomy is that there might be excess mucus secretion from the distal limb which interferes with maintaining a perfect seal of ileostomy appliance. The major advantage of a loop-end ileostomy is that it allows maintenance of blood supply and a spigot configuration under circumstances in which this may have otherwise been impossible.

Figure 12: The technique of construction of a loop- end stoma



Post-operative care and complications

The incidence of complications following an ileostomy has been varied ranging from 10 to 70%, but many patients experience at least a transient episode of skin irritation due to the alkaline nature of the effluent, which continues to be the most common complication. Around 500-800 ml of thick

liquid content will be passed everyday and an ideally constructed stoma should tolerate this effluent well and there should be no prolapse or retraction. A well-fixed appliance will not leak and damage the skin. Stoma-related complications may be classified as those that occur early (within 1 month of surgery) or late (>1 month postoperatively). The most common early complications are peristomal skin irritation, leakage, high output, and ischemia. The most commonly reported late complications include parastomal hernia, prolapse, obstruction, and stenosis. Parastomal hernia and prolapse have already been explained under the section- complications following colostomy.

In a 20-year retrospective review of 1616 patients in the Cook County Hospital database, Park et al. reported a 34% incidence of complications, 28% being early and 6% classified as late[18]. The most common early complications were skin irritation (12%), pain associated with poor stoma location (7%), and partial necrosis (5%), and the most common late complications were also skin irritation (6%), prolapse (2%), and stenosis (2%). Of note, complications varied greatly by service with ostomies created by general surgeons associated with a 47% complication rate, whereas the complication rate for colorectal surgeons was 32%. Duchesne et al. retrospectively reviewed 164 ostomates cared for at Charity Hospital in New Orleans[19]. The overall complication rate was 25%; 38% of the complications were early; and 62% were late. As is typically the case, ileostomies were associated with a higher complication rate than

colostomies. The most common complications were necrosis (22%), prolapse (22%), skin irritation (17%), and stenosis (17%). Risk factors for complications included inflammatory bowel disease, ischemic colitis, and increased body-mass index. As others have observed, obesity markedly increased the risk of skin irritation. Of particular note was the six fold decrease in stoma complications when an ET was involved in the patient's care.

Saghir et al. retrospectively reviewed 121 stoma patients and reported a 67.5% complication rate, 41% of which were considered minor, and 26% were considered major. Nine of the patients (7%) required revisional surgery. Complications were associated with older age, increased medical co morbidities, and an ostomy created by other than a colorectal surgeon.

Skin irritation and leakage :

As mentioned, it is the most commonly encountered complication and an ileostomy is the culprit on most occasions owing to the caustic, liquid effluent which, in an improperly constructed stoma could damage the peristomal skin. Other causes that have been attributed include moist skin before placing the appliance, inadequately large stoma face plate with the skin barrier, allergy to the adhesive, overfilled or a leaky appliance[20]. Control of skin excoriation could at times be difficult, but it is reversible in most cases with conservative methods

which include antibiotics and topical application of zinc oxide. Changing the stomal appliance and refashioning the stoma could also help in many cases.

Figure 13 :Showing local sepsis following stoma and an ileostomy with prolapse

High output :

For obvious reasons, a high-output state is typically described in association with an ileostomy rather than a colostomy. Marked diarrhea and dehydration occur in 5% to 20% of ileostomy patients, with the greatest risk occurring in the early postoperative period. An ileostomy usually functions by the third or fourth postoperative day. The output typically peaks on the fourth postoperative day, with an output of up to 3.2 L reported[21]. Since the ostomy effluent is rich in sodium, hyponatremia can be a problem. The particular window of vulnerability for dehydration appears to be between the third and eighth postoperative day. In time, the small bowel typically adapts with mucosal hyperplasia and there is a steady decrease in ostomy output. This can be

temporarily managed in an otherwise healthy adult with rehydrating solutions. However, patients who have lost considerable absorptive surface owing to previous bowel resection and/or those with recurrent/residual Crohn's disease are at particular risk. In addition to the loss of absorptive surface area, ileal resection also removes the fat or complex carbohydrate stimulation of the so-called ileal brake that slows gastric emptying and small bowel transit. Fluid and electrolyte maintenance in these patients may require a period of parenteral hydration and nutrition.

Ileostomy diarrhea may be treated in its milder forms with fiber supplements or cholestyramine, which can thicken secretions. Histamine H_2 receptor antagonists or proton pump inhibitors are often useful in reducing gastric fluid secretion, especially in the first 6 months after surgery when hypergastrinemia is most severe. Often, ant motility agents (e.g., loperamide or diphenoxylate) or opiates (e.g., codeine or tincture of opium) may be required to slow intestinal transit. In refractory cases, somatostatin analogue has been used with some success[22]. Somatostatin reduces salt and water excretion and slows gastrointestinal tract motility. However, its clinical usage has met with variable results. Special mention is made of patients with a high-output ostomy required to treat complications of an anastomotic leak. Good results have been reported with exteriorizing the leak and reinfusing the ostomy effluent into the

downstream limb until gastrointestinal continuity can be restored. This has led to weaning parenteral nutrition in a substantial number of patients.

A related problem in patients with an ileostomy is the development of urinary stones. The obligatory loss of fecal water, sodium, and bicarbonate reduces urinary pH and volume. Whereas approximately 4% of the general population develops urinary stones, the incidence in patients with an ileostomy is approximately twice that. Whereas uric acid stones comprise less than 10% of the calculi in the general population, they comprise 60% of stones in ileostomy patients. There is also an increase in the incidence of calcium oxalate stones.

Serositis

The majority of post-operative complications historically associated with an ileostomy were related to serositis which resulted in a partial obstruction at the stoma itself. These patients suffered massive fluid and electrolyte disturbance and the enormous sequestration of fluid secondary to bowel obstruction in such patients usually resulted in death. Historically termed "ileostomy dysfunction", the phenomenon was anticipated after construction of each stoma. Turnbull and Brooke prevented the above phenomena by successfully describing the technique of everting the stoma which prevented serositis. Since then, most of the complications of ileostomy have been related to improper technique in constructing a stoma[23]. As there is no sphincter in the

ileostomy, many patients may experience problems involving odor and gas. These can usually be managed by paying attention to food and medications ingested, by maintaining meticulous personal hygiene and by using various deodorant products.

An unusually long-term risk to the patient is dehydration which occurs in hot weather and during strenuous physical activity. This is exacerbated by a simple diarrhea so that many patients can go for dehydration before adequate control is achieved by medication. Hence it is of utmost importance for patients to maintain adequate intake of fluid and electrolytes.

Bowel obstruction

It is estimated that 23% of patient with an ileostomy ultimately develop a bowel obstruction. These are most commonly related to adhesions, but internal hernias and volvulus are also implicated[24]. Theoretically, suturing the bowel to the posterior part of the abdominal wall has been suggested to decrease the incidence of bowel obstruction but retrospective analyses have failed to prove a distinct advantage[25]. Management is however similar to any other patient presenting with a mechanical small bowel obstruction. An interesting cause of bowel obstruction seen in ostomates is food bolus obstruction, which is usually related to ingestion of some high fibrous food with a high residual component. Patients usually present with cramping abdominal pain, dehydration and

vomiting. These patients need to be admitted and started on intravenous fluid replacement. The stomal problem should be dealt by introducing a 24F Foley catheter in the stoma and by inflating the balloon with 3-5 ml of saline just beneath the fascia.

The stoma is irrigated with 50 ml of saline and the return of clear fluid or food particles is noted. A clear return suggests a more proximal obstruction and necessitates further evaluation using water-soluble contrast. Return of food particles indicates food blockage and a continuous irrigation would eventually result in clearing of all food debris and return of normal stomal function. This procedure often requires 12-24 hours of irrigation and intravenous fluid supplementation.

Rare complications include a para-ileostomy fistula which is seen in Crohn's disease which is managed by modifying the appliance so that the fistula is allowed to drain into the appliance. Further evaluation and treatment of the fistula should then be carried out. It is not unusual for patients to lacerate the stoma using a mal-fitting appliance. The absence of nerve fibers in the ileum would compound the injury. Destruction of peri-stomal skin can be so severe as to require split skin grafting. With meticulous pre-operative planning and marking, a good surgical technique, good post-operative care and a snuggly fitting stomal appliance, most patients with conventional ileostomies would lead normal lives.

CONTINENT ILEOSTOMY

The construction of an intestinal reservoir for feces was first described in 1967 by Nils Kock. His original description was based on the theory that interruption of coordinated peristalsis would enhance capacity. J- and S-shaped pouches have been used with similar results and an S-shaped pouch is described here.

The construction of a continent ileostomy, or Kock pouch, can be broken into four components:

- The creation of a pouch
- The creation of a nipple valve, which provides continence
- The suspension of the pouch from the abdominal wall in such a way as to prevent slippage of the nipple valve
- The creation of a stoma.

Although the ileal pouch anal anastomosis is now preferred by most patients requiring proctocolectomy, the continent ileostomy remains a viable alternative to the Brooke ileostomy for certain categories of patients, which include (a) patients with an existing conventional Brooke ileostomy with no possibility of an ileal pouch anal anastomosis (no anal sphincter) who want to improve their quality of life, (b) patients requiring a proctocolectomy who wish to preserve continence but are not suitable candidates for an ileo-anal

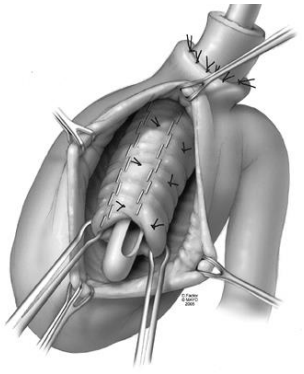
anastomosis, most often because of poor anal sphincter function, (c) the rare patients whose daily work takes them away from toilet facilities for long periods of time and who prefer a continent ileostomy to an ileo-anal anastomosis, and (d) patients with a failed ileo-anal anastomosis who desire to preserve continence and avoid an external appliance if the failure is unrelated to Crohn's disease or severe pouchitis.Use of the Kock pouch should be discouraged in (a) older patients who may be more prone to postoperative complications, including valve dysfunction, and may not tolerate reoperation, (b) patients with Crohn's disease, (c) obese patients, (d) critically ill patients such as those with toxic megacolon, (e) psychologically unfit patients who may not be able to intubate properly or tolerate complications and reoperations, and (f) patients in whom a significant amount of small intestine has already been removed.

The technique :

The distal 45 cm of the ileum is used to construct the reservoir, the valve, and the outflow tract (efferent limb). Beginning 15 cm from the cut end of the distal ileum, a 30-cm segment of ileum is measured and fashioned into a ‘U’. Theantimesenteric borders of the two 15-cm limbs of the U are approximated with continuous suture of 2-0 chromic catgut. The two limbs are then incised on their antimesenteric borders, with the incision extending 4 to 5 cm longer on the afferent limb than on the efferent limb so that the two limbs separate as the pouch is constructed. A second layer of continuous chromic catgut is used to approximate the mucosa and complete the posterior wall of the reservoir .

The valve is then fashioned. The serosal surface of the efferent limb of the ileum is scarified, with the electrocautery beginning at the pouch and extending for a distance of 10 cm toward the cut end. The peritoneum of that same segment is also stripped from the adjacent mesentery, which is also defatted. These maneuvers are designed to promote adherence of the ileum and its mesentery when the efferent limb is intussuscepted into the pouch to fashion the valve. The 10-cm efferent limb is intussuscepted into the pouch to form a nipple valve of approximately 5 cm in length. The intussusceptum is fixed in place with through-and-through sutures of 2-0 Vicryl, and three cartridges of stainless steel staples along both sides of the mesentery, care being taken to avoid injury to the vascular supply, and immediately opposite the mesentery using the GIA (U.S. Surgical Corp., Norwalk, CT) auto suture apparatus .

Figure 14 : Construction of the nipple valve



The placement of the staples and sutures is facilitated by stenting the lumen of the intussusceptum with a No. 28 French catheter. The bottom of the U is then folded over to construct the anterior wall of the reservoir, using two layers of continuous 2-0 chromic catgut. The outflow tract is sutured to the base

of the pouch with interrupted 3-0 nonabsorbable sutures at the exit of the limb from the pouch to further anchor the intussusceptum in place. A circumferential defect is created through the abdominal wall just above the pubic hairline in the right lower quadrant, and the outflow tract is brought through the defect and amputated flush with the skin and matured into a stoma with interrupted 3-0 chromic catgut. The length of ileum between the pouch and the stoma should be kept short to avoid tortuosity and facilitate later intubation of the reservoir. This is aided by suturing the pouch to the undersurface of the anterior abdominal wall so that the nipple valve is perfectly aligned with the stoma .A No. 28 French catheter is passed through the stoma, efferent limb, and nipple valve, and its tip is positioned within the lumen of the pouch before the incision is closed. A suture of heavy silk is tied around the catheter at the level of the stoma so that the exact position of the catheter can easily be ascertained in the postoperative period. These precautions help prevent pouch perforation or tube slippage during postoperative recovery.

The advantages of continent ileostomy[26,27] are

- The patient need not wear an appliance
- The patient is continent between intubations
- He or she may experience a better quality of life.

The disadvantages are

- Not all patients are continent
- It does require multiple intubations during the day
- There can be difficulty in intubation and
- The surgery is prolonged and carries a substantial risk of complications.

URINARY CONDUIT

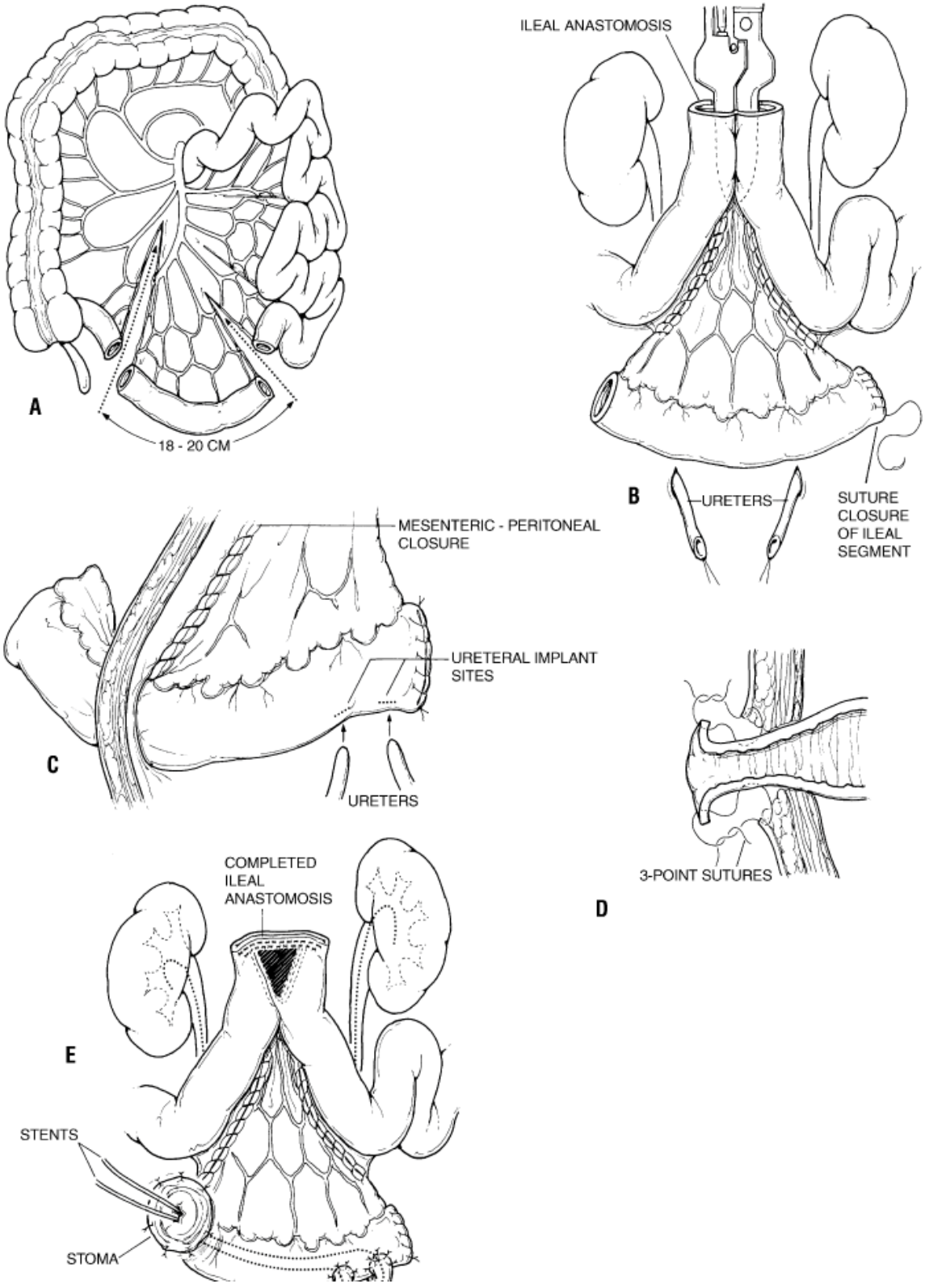
The urinary conduit is constructed of a segment of intestine with well-maintained vascularity so that it can be connected to the urinary tract to allow egress of urine through the abdominal wall via a stoma constructed exactly like an ileostomy. It is not intended to have any type of reservoir capacity but merely to provide an open conduit. This urinary conduit is constructed most often after removal of the urinary bladder for invasive cancer[28]. It is also used for management of severe obstructive uropathy, the congenital abnormalities of spina bifida, meningomyelocele, or bladder exstrophy, and for trauma to the spinal cord resulting in a severely neurogenic bladder. The incidence of this surgery for congenital and traumatic disorders is decreasing as other means of emptying the bladder are devised. The cystectomy, construction of the urinary conduit, and ureterointestinal anastomosis are most often carried out by urologists, but the construction of the stoma, as well as restoration of intestinal continuity, may be done by a surgeon more experienced in intestinal and stoma surgery.

The basic principles of construction of the conduit and stoma involve isolation of a segment of intestine, with maintenance of the mesenteric blood supply and enough mobility to allow the distal end to be used as a stoma and the proximal end to serve as the site for ureteral implantation. It is most important to maintain the isoperistaltic direction of the intestine, especially if the conduit is constructed of sigmoid colon. The conduit must not be made of irradiated bowel, even if this requires using either colonic or proximal small intestinal conduits. If the stoma is improperly constructed, there may be a stasis of urine, resulting in reflux and damage to the proximal tract.

The surgical technique consists of choosing a long enough segment of small intestine to allow the stoma to be constructed at the level of the abdominal wall and still allow the proximal end to reach close enough to the retro peritoneum to preclude tension on the ureterointestinal anastomoses[29]. Usually, 18-20 cm of intestine is enough, but this must be modified if there is a shortened mesentery or a massively obese abdominal wall. It is in these latter situations that the loop-end stoma, supported over a small rod, can be advantageous. After the segment of intestine is chosen, the mesentery at the distal point is incised to allow enough mobility for reaching the abdominal wall. The mesentery at the proximal site of transection is incised only in a limited fashion, and care must be taken to preserve a generous blood supply. Intestinal continuity is restored, with the intended conduit positioned posterior to the restored intestine. The

ileoileal anastomosis may be completed in any fashion that uses sutures or staples. The conduit is then cleaned of intestinal content, and the proximal end is closed. Closure must be done with absorbable sutures, because staples can lead to stone formation. It is then preferable to make the opening in the abdominal wall to construct the stoma as previously described for an ileostomy. This procedure ensures that the ureteral anastomosis will be completed with the conduit in its final position and without the need for applying tension to bring the intestine through the abdominal wall. The ureteral anastomoses are performed, and stents are placed. All aspects of the stoma construction are the same as those for an ileostomy except that the appliance must contain a valve to allow constant drainage since the volume of urine is high and its weight would tend to pull the appliance off if constant drainage were not maintained. In the distant postoperative period, this problem is solved by the patient emptying the appliance frequently and by sleeping attached to a night drainage system.

Figure 15: The technique of constructing an ileal conduit



LAPAROSCOPIC ILEOSTOMY AND COLOSTOMY

Laparoscopic creation of an ileostomy, whether alone or in conjunction with bowel resection can be created easily. As in the case of an open ileostomy, it is done to protect an anastomosis lower down or to provide diversion proximal to complex anovaginal fistula repair or anal canal reconstruction. Basic principles include patient and site selection are common to the traditional technique[30].

At the time of trocar placement, the siting of the stoma should be considered. A trocar can be placed through the future stoma trephine, but sites adjacent to the trephine within the footprint of the stomal appliance must be avoided. The existing trocars placed for the bowel resection procedure can be used for the laparoscopic creation of the stoma also. If the ileostomy is created without any additional abdominal surgery, then only two ports are commonly necessary : one at the umbilicus for the camera and a second through the stoma site to manipulate the terminal ileum. Under either circumstance, the operative principles are similar.

The terminal ileum is located just proximal to the ileocecal valve. The bowel is followed retrograde until a segment that easily reaches the abdominal wall at the stomal site is identified. Pnuemoperitoneum should be deflated when assessing ileal length, as the abdomen will not distended when the ileostomy is

created or in use. Ileal mobilization is rarely required. Extreme care should be taken ensure proper orientation of the bowel. The proper loop of bowel is grasped with a grasper through the stoma trephine and proximal and distal bowels carefully identified. If an additional port is available, the tip of a marking pen is grasped with a laparoscopic grasper and the distal end marked just beyond the grasper.

Pneumoperitoneum is released and the stoma trephine is created in standard fashion around the grasper. The loop is then eviscerated carefully without twisting. Once this is done, pneumoperitoneum is reestablished and proper orientation is confirmed. Once proper orientation is confirmed, the stoma can be matures in standard fashion. A loop, end-loop or end ileostomy can be created as indicated based on the clinical setting. After completion of stoma maturation, pneumoperitoneum is reestablished, proper orientation is confirmed and the abdominal cavity is checked for bleeding and closed. Laparoscopic procedures offer greater flexibility in technique and even though no long term comparative studies are available at present, it is expected that they would provide a marginal benefit in the overall outcome of the procedure[31].

MATERIALS AND METHODS

Materials: All patients admitted to GRH and subsequently managed with a stoma.

Methodology: All patients admitted in Govt. Royapettah Hospital and later operated and managed with a stoma were closely followed up from the date of admission to the date of discharge and the above perspectives were studied.

Type of Study: Descriptive Study

Sample Size: 100

Inclusion Criteria: All patients who were admitted in Govt. Royapettah Hospital, in the Department of General Surgery between May 2011 and November 2013 and managed with a stoma were taken for study.

Exclusion criteria:

1. Patients who were managed with a stoma done elsewhere and referred to our hospital for further care were not included in the study.
2. Pediatric cases were excluded from the study.
3. Stomas involving upper GIT – esophagus and stomach, constructed for feeding purposes like jejunostomy and those

involving non-GIT sites viz. Urethrostomy were excluded from the study.

Data collection: The data of each patient was collected in a specially designed proforma which is enclosed.

ROUTINE INVESTIGATIONS

- HB, TC, DC
- BT, CT, PT, APTT
- LFT
- Serum electrolytes
- X-ray erect abdomen, X-ray chest P-A view
- USG abdomen and pelvis

SPECIAL INVESTIGATIONS

- CECT abdomen and pelvis
- MRI pelvis

Ethical committee clearance was taken from the institution to conduct the study and the certificate is enclosed.

OBSERVATION AND RESULTS

Table 1: Age distribution of patients studied

Age groups (years)	Frequency	Percentage
15-25	10	20.0
26-35	5	10.0
36-45	13	26.0
46-55	8	16.0
56-65	13	26.0
>65	1	2.0

A total of 50 patients were included in the study. The maximum number of patients

were in the age group of 36-45 and 56-65 (n=13).

Figure 16: Age distribution of patients studied

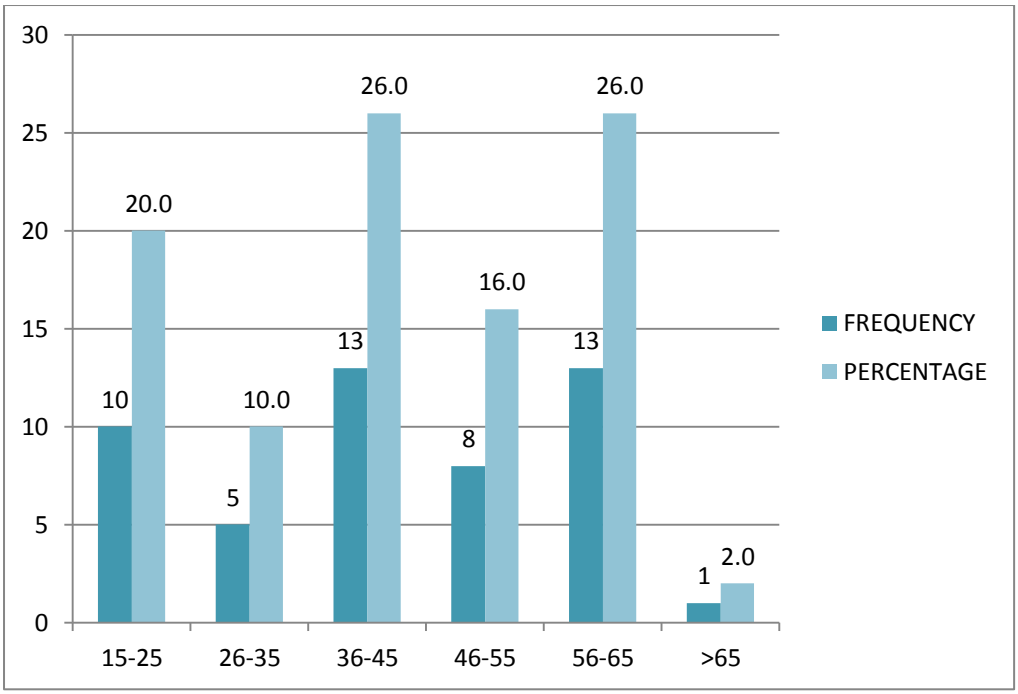


Table 2: Sex distribution of patients studied

Sex	Frequency	Percentage
Male	38	76%
Female	12	24%

Of the total 50 patients included in the study, 38 were male patients and 12 were female patients.

Figure 17: Sex distribution of patients studied

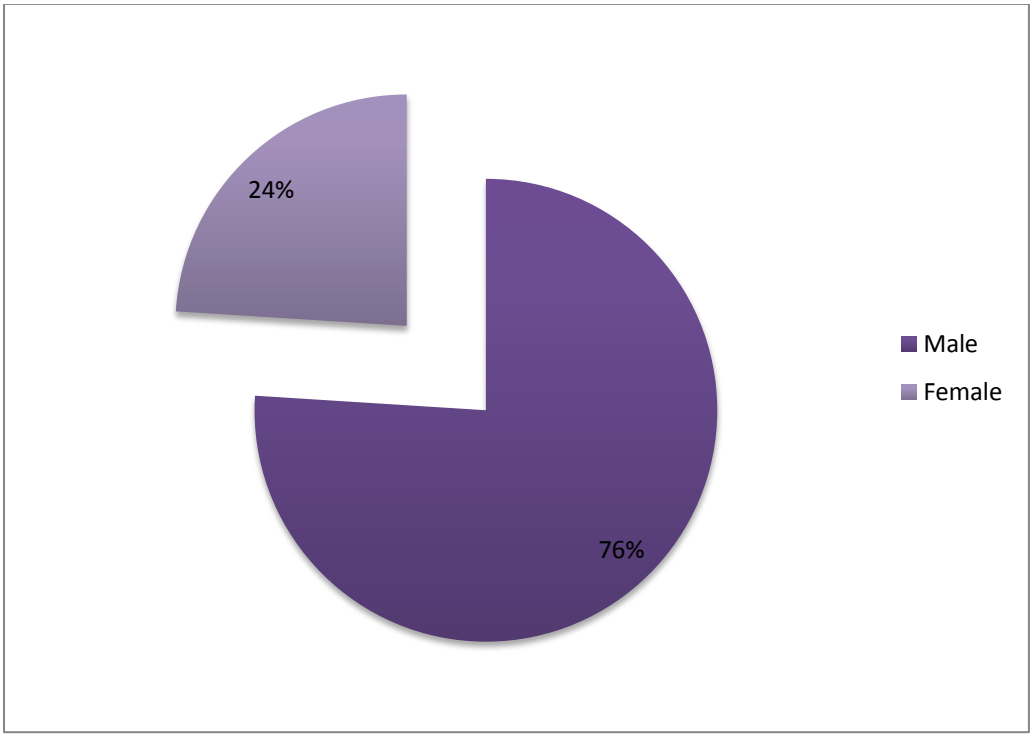


Table 3: Indications for surgery

Diseases	Frequency	Percentage
Blunt abdominal trauma	2	4.0
CA Rectum	3	6.0
Diverticular disease	2	4.0
Hollow-viscus Perforation	17	34.0
Inflammatory bowel disease	2	4.0
Intestinal Obstruction – Benign	7	14.0
Intestinal Obstruction – Malignant	8	16.0
Penetrating Abdominal trauma	5	10.0
Peri-anal sepsis	2	4.0
Acute Mesenteric Ischemia	2	4.0

Hollow viscus perforation was the main indication for surgery which accounted for nearly 34% followed by malignant intestinal obstruction.

Figure 18 : Indications for surgery

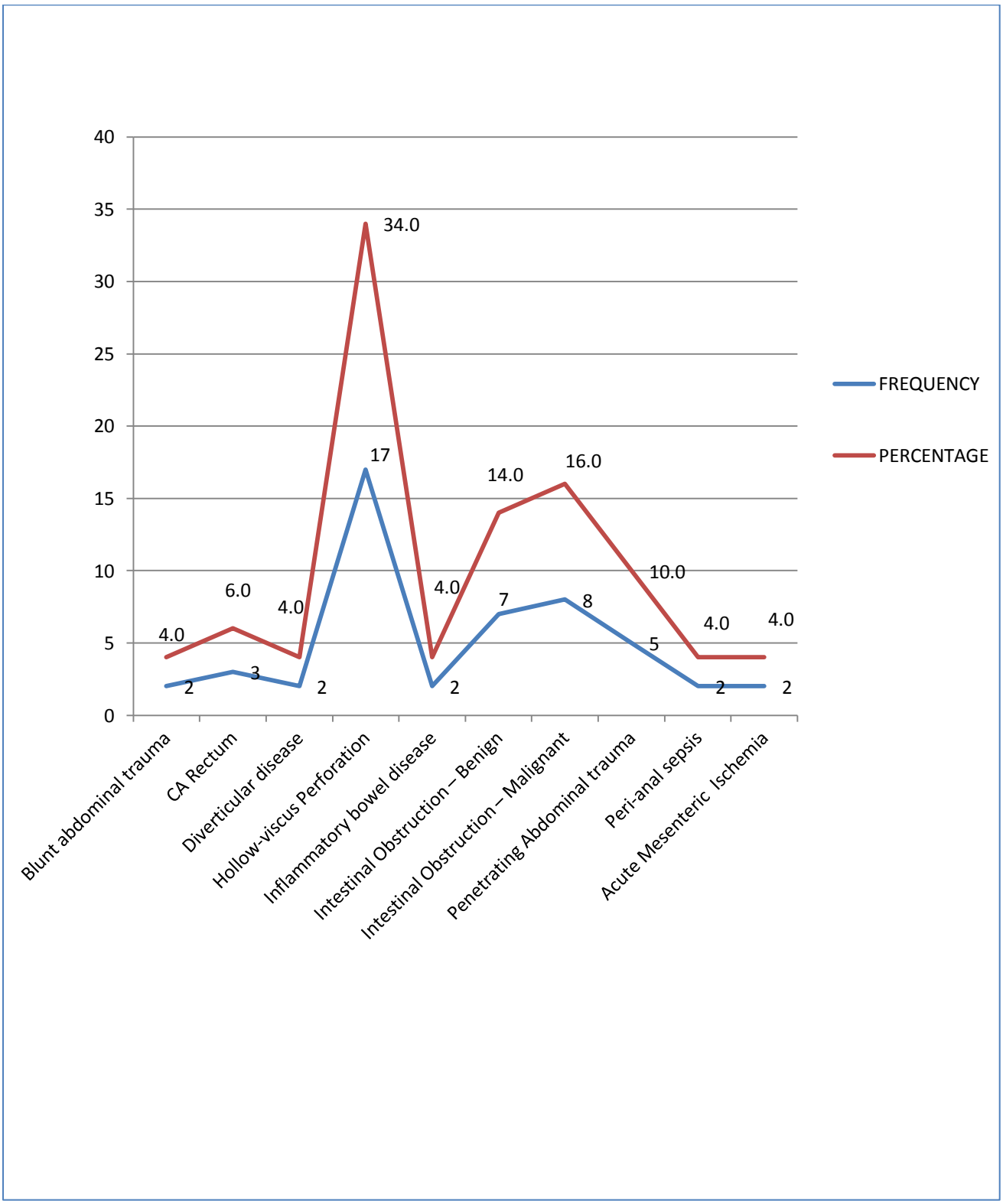


Table 4: Nature of the disease

Nature of disease	Frequency	Percentage
Benign	39	78%
Malignant	11	22%

Of the 50 patients for whom a stoma was constructed, benign diseases accounted for 78%.

Figure 19: Nature of the disease

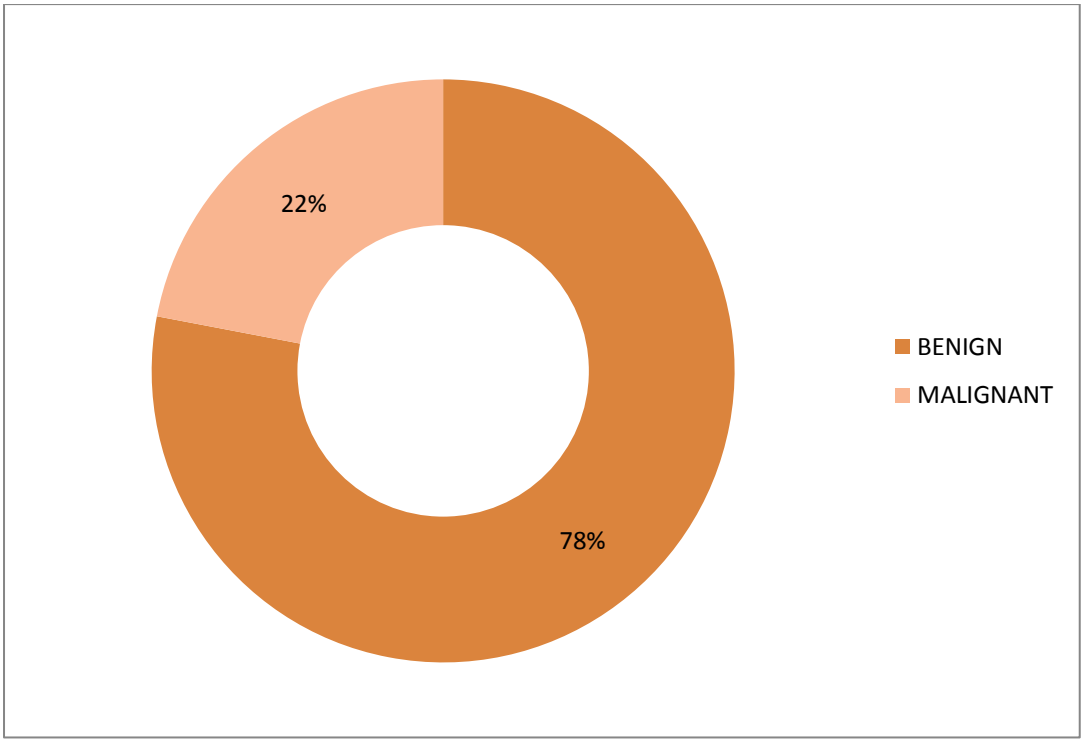


Table 5 :Nature of presentation

Nature of presentation	Frequency	Percentage
Elective	4	8%
Emergency	46	82%

82 % of t total patients presented as an acute emergency and only 4% patients had an elective indication for surgery.

Figure 20: Nature of presentation

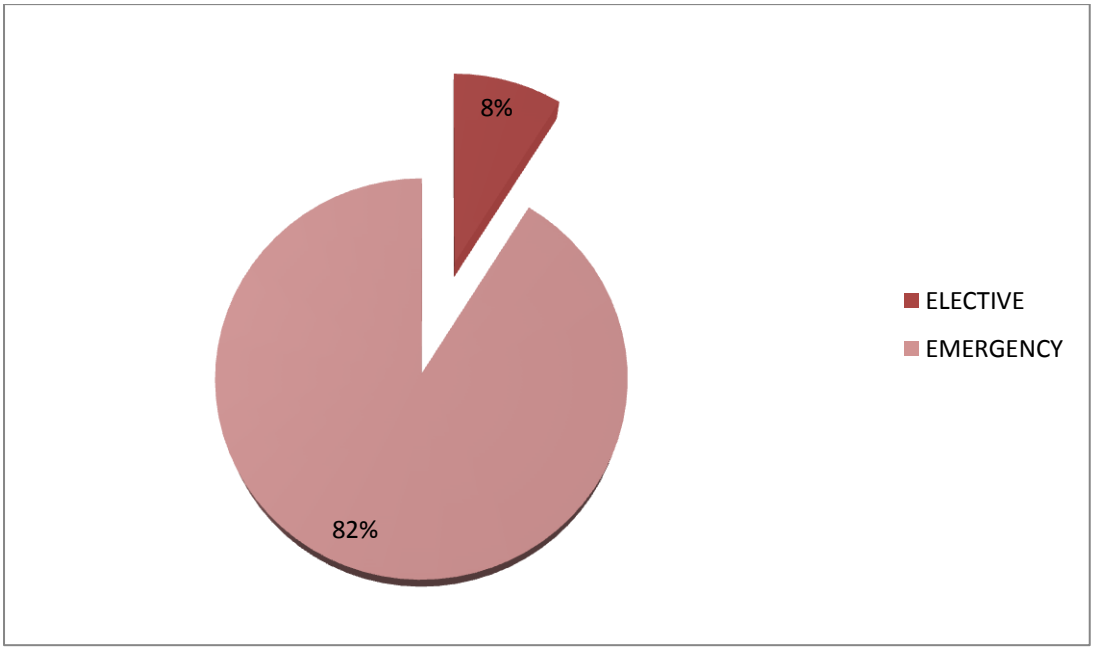


Table 6 :Indication for stoma

Indication for stoma	Frequency	Percentage
Decompression	4	8%
Diversion	46	92%

Of the 50 patients, 92 % needed a stoma for diversion of the enteral contents and only 8% needed decompression as the principle behind a stoma.

Figure 21 :Indication for stoma

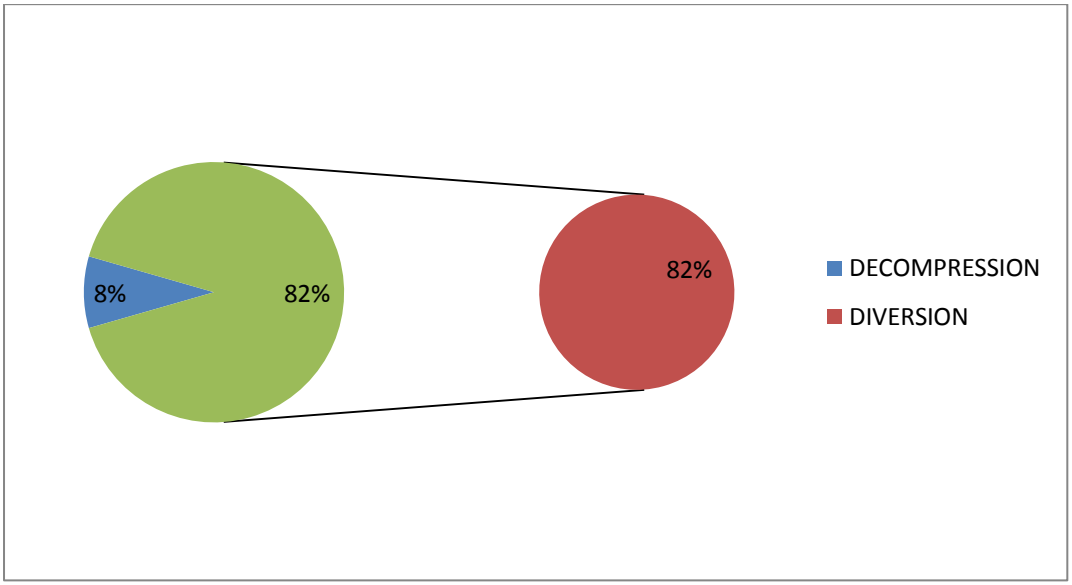


Table 7:Ttype of stoma

Type of stoma	Frequency	Percentage
End Colostomy	4	8.0
End Ileostomy	4	8.0
Loop Colostomy (Sigmoid)	2	4.0
Loop Ileostomy	28	56.0
Proximal Jejunostomy and End Ileostomy	2	4.0
Transverse Loop Colostomy	10	20.0

Of the 50 patients, 56% patients underwent a loop ileostomy, which was the commonest procedure done (n=28) followed by a transverse loop colostomy.

Figure 22:Type of stoma

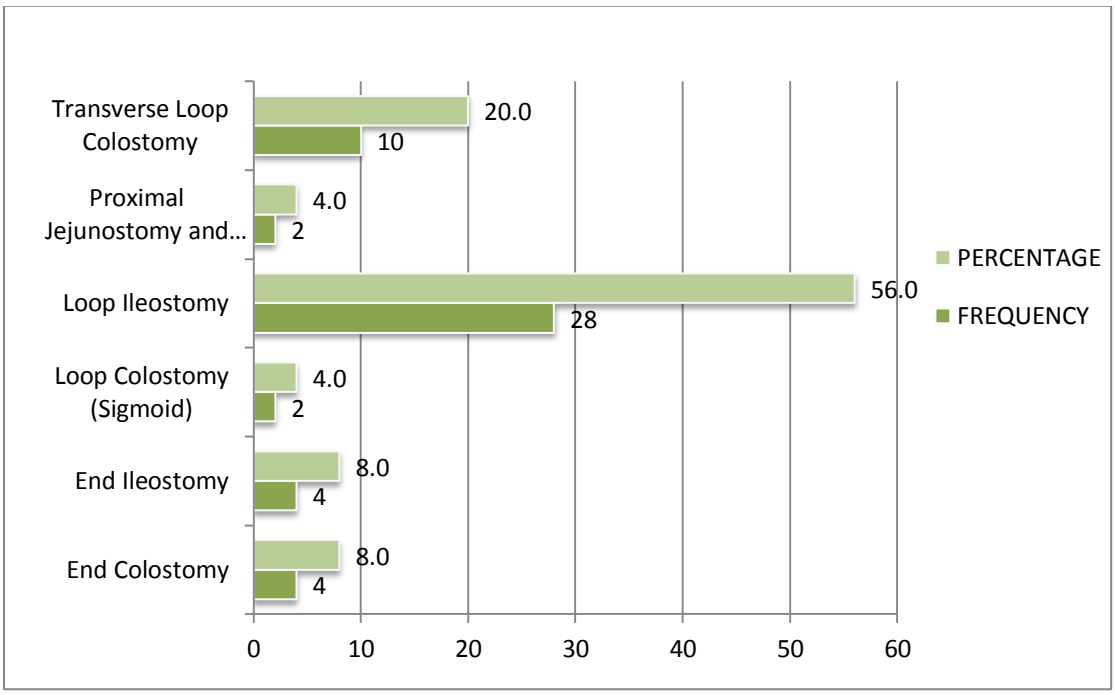


Table 8 :Nature of stoma

Nature of stoma	Frequency	Percentage
Permanent	4	8%
Temporary	46	92%

Of the 50 patients, only 8% had a permanent stoma while 92 % had a temporary stoma which was eventually reversed.

Figure 23 :Nature of stoma

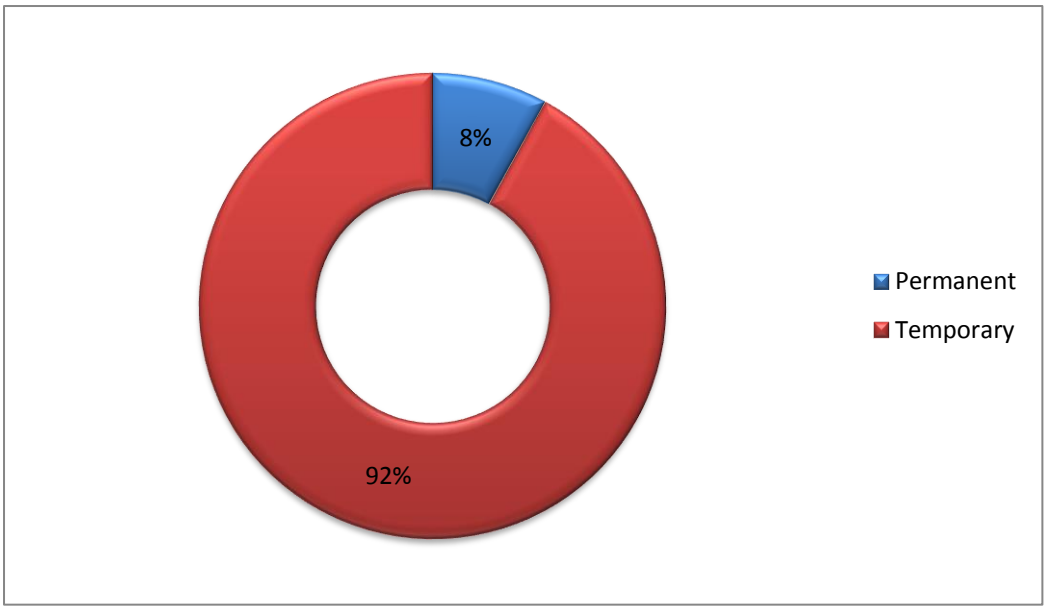


Table 9: Complications of stoma

Complications	Frequency	Percentage
Nil	38	76
Hernia	2	4
Local Sepsis	5	10
Necrosis	3	6
Prolapse	1	2
Retraction	1	2

Local sepsis was the commonest complication associated with a stoma which was present in 10 % of the patients. However the majority of patients did not present with any complications (n=38)

Figure 24: Complications of stoma

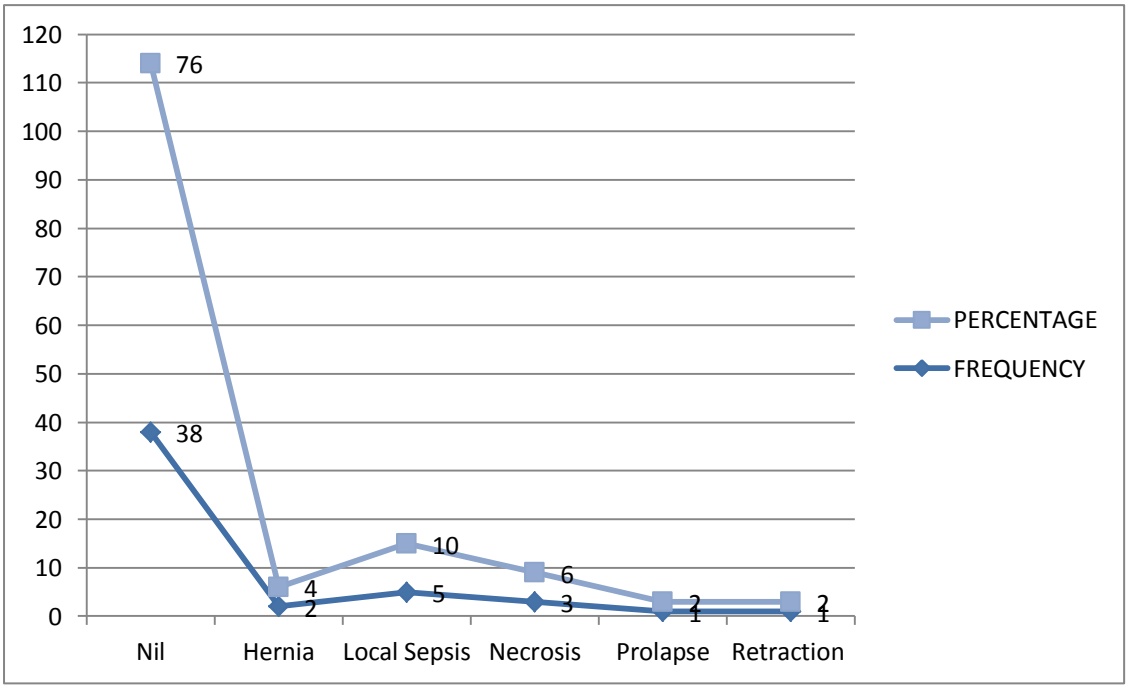


Table 10 :Complications associated with each type of stoma

COMPLICATIONS	END COLOSTOMY	END ILEOSTOMY	LOOP COLOSTOMY (SIGMOID)	LOOP ILEOSTOMY	PROXIMAL JEJUNOSTOMY AND END ILEOSTOMY	TRANSVERSE LOOP COLOSTOMY
NIL	3	1	1	21	2	10
HERNIA	0	2	0	0	0	0
LOCAL SEPSIS	0	1	0	4	0	0
NECROSIS	0	0	0	3	0	0
PROLAPSE	1	0	0	0	0	0
RETRACTION	0	0	1	0	0	0

Of the 50 patients with a stoma, Loop ileostomy was associated with maximum number of complications while transverse loop colostomy was not associated with any complication at all. However this data was not found to be statistically significant ($p<0.05$) and hence loop ileostomy cannot be assumed to be more morbid than the other procedures.

Figure 25 :Complications associated with each type of stoma

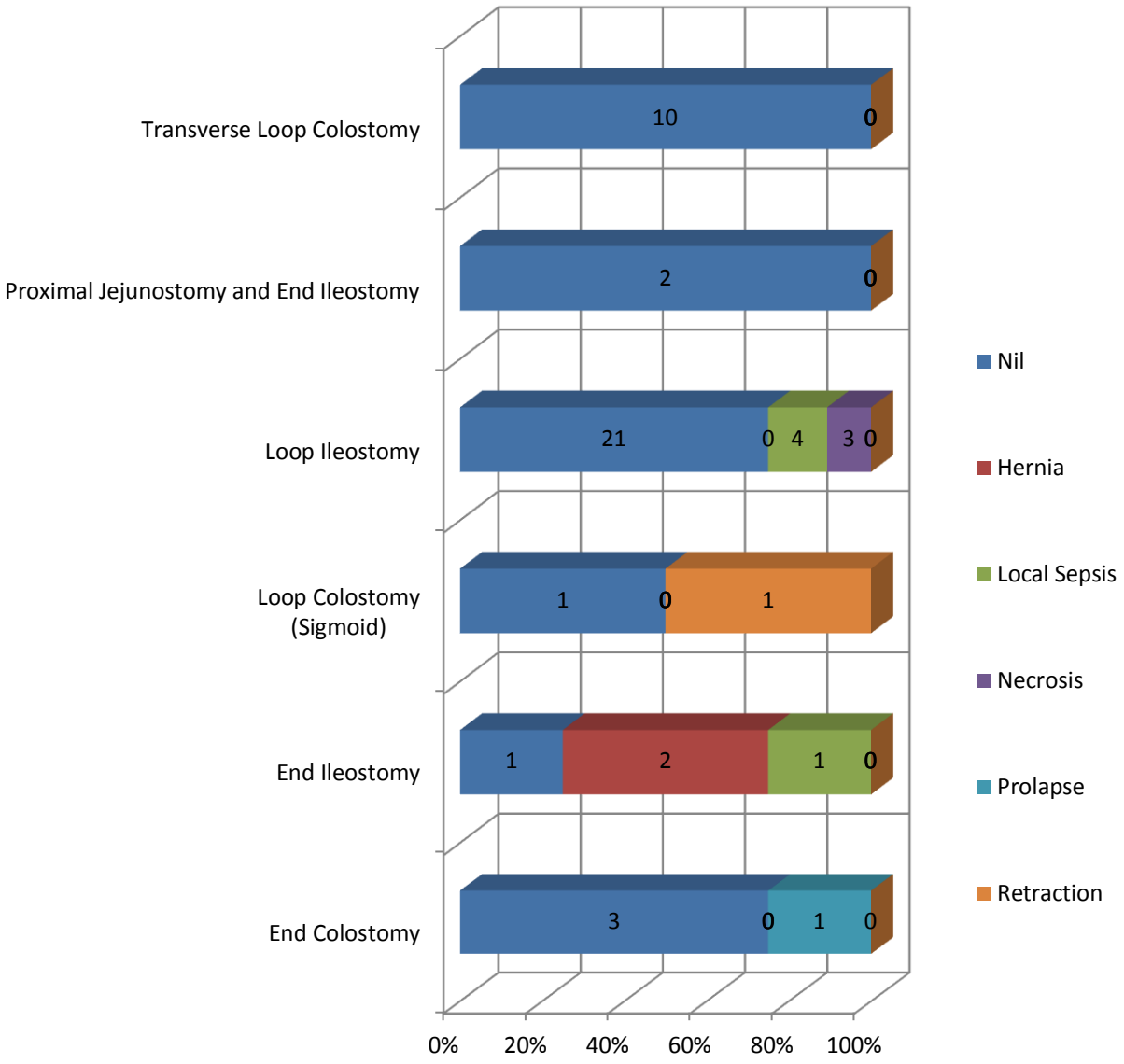


Table 11 :Patient compliance to the procedure

Patient compliance	Frequency	Percentage
Good	37	74
Average	8	16
Poor	5	10

Of the 50 patients, most of them (74%) showed good compliance with the procedure.

Figure 26 :Patient compliance to the procedure

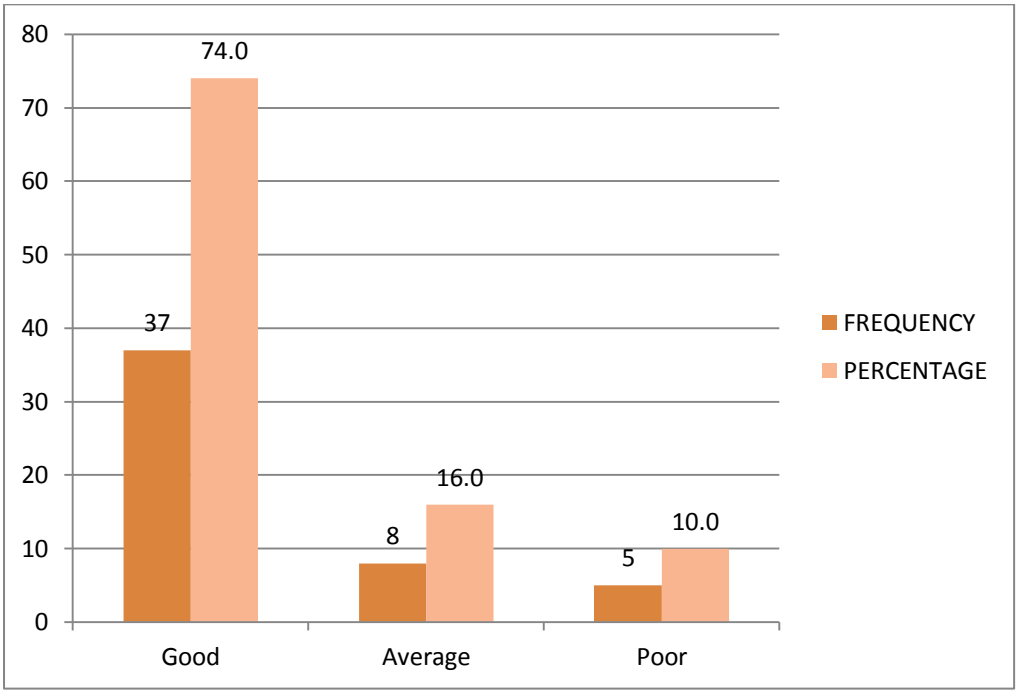


Table 12 :Complicationof stoma vs compliance

Complications	Good	Average	Poor
Nil	33	5	0
Hernia	1	1	0
Local sepsis	0	0	5
Necrosis	1	2	0
Prolapse	1	0	0
Retraction	1	0	0

Of the 50 patients, local sepsis as a complication resulted in a poor compliance in all patients while even certain high risk complications like prolapse and retraction were well tolerated.

Figure 27 :Complication of stomavs compliance

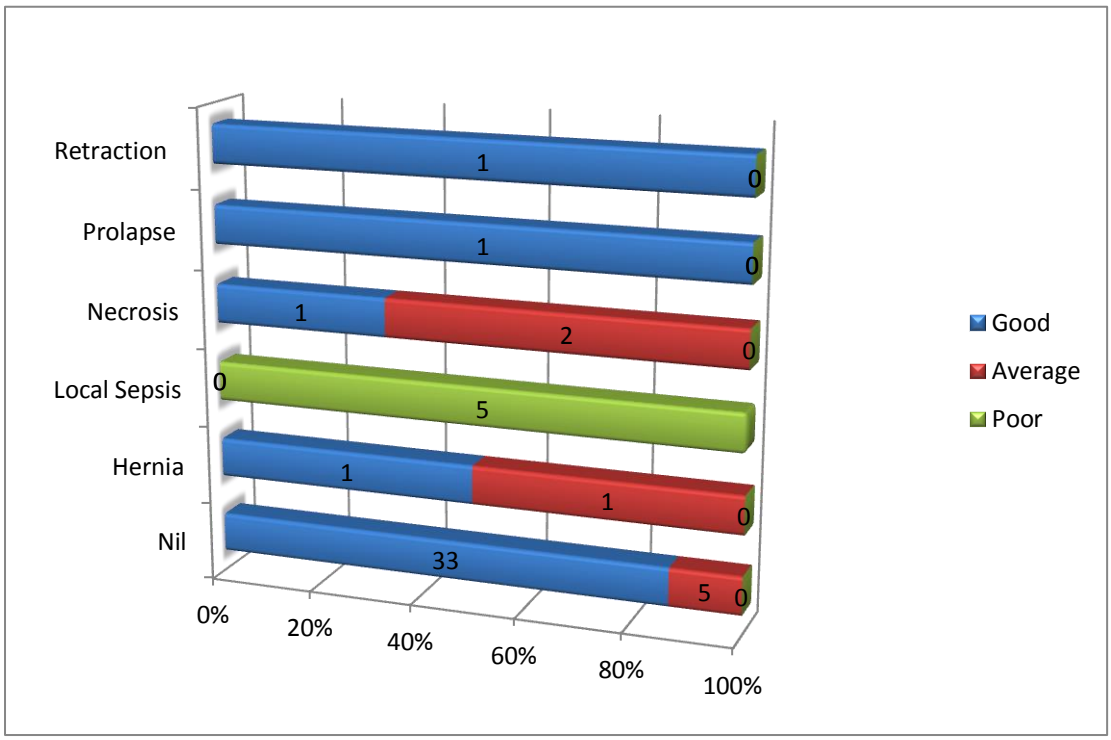
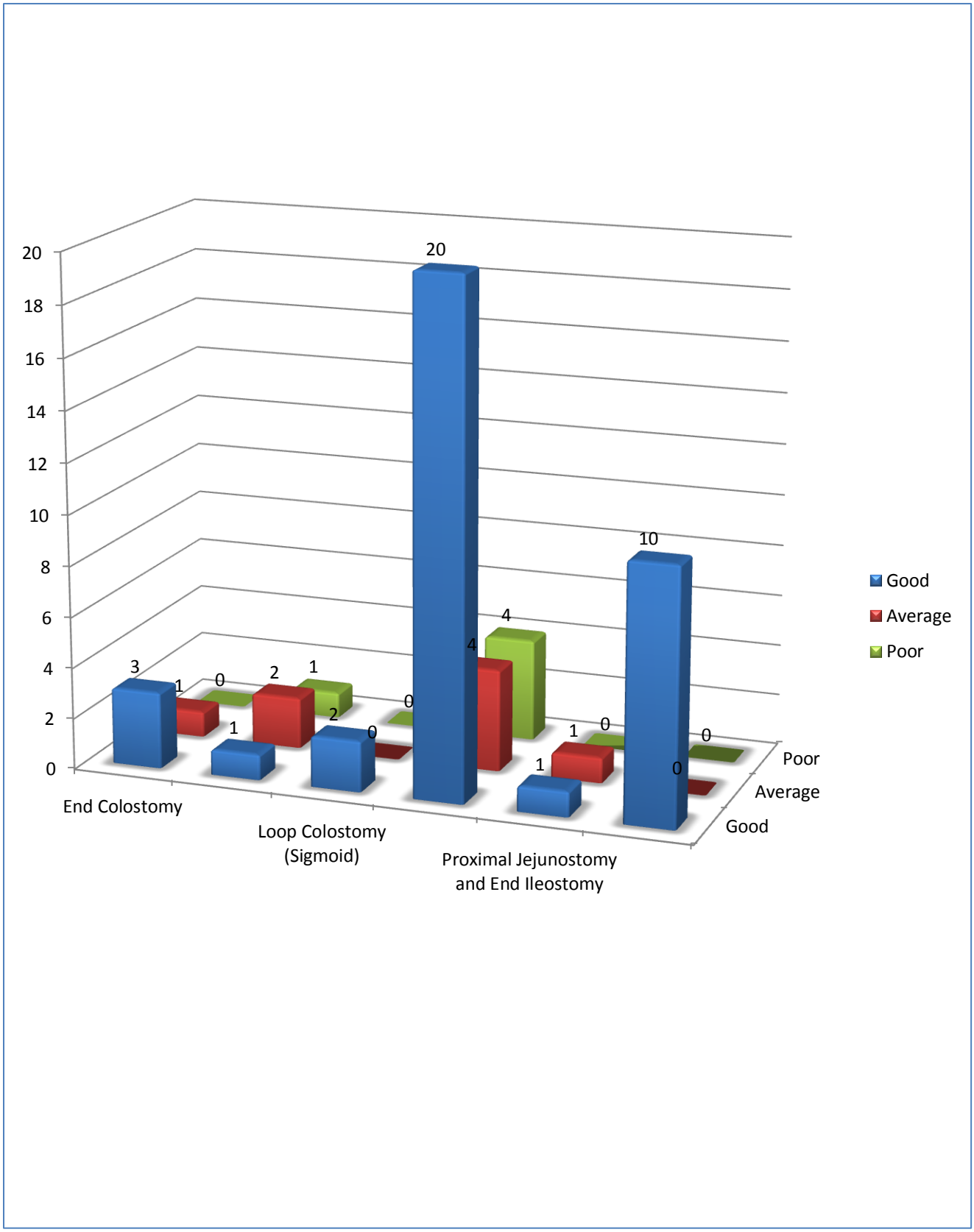


Table 13 :Type of stoma vs compliance

Patient compliance	Good	Average	Poor
End Colostomy	3	1	0
End Ileostomy	1	2	1
Loop Colostomy (Sigmoid)	2	0	0
Loop Ileostomy	20	4	4
Proximal Jejunostomy and End Ileostomy	1	1	0
Transverse Loop Colostomy	10	0	0

Loop ileostomy was commonly associated with most complications and this had an overall impact on the patient compliance. 4 patients with loop ileostomy showed poor compliance. This data was not shown to have any statistical significance ($p<0.05$) and hence it is safe to say that loop ileostomy although shown to be numerically associated with poor patient compliance, is not inferior to any other type of stoma constructed. It is worth noting that transverse loop colostomy was not associated with any complications at all.

Figure28 :Type of stoma vs compliance



ANALYSIS AND DISCUSSION

Although the first stomas were described and constructed in the 19th century, they were associated with innumerable complications and hence did not establish themselves as a favorite amongst surgeons as well as patients. With the advent of better surgical techniques, asepsis and post-operative care, the traditional complications were associated with much lesser morbidity and the field of stoma saw a proportional increase in patient acceptance of the procedure and its aftermath. Nevertheless a stoma, though extremely beneficial and at times life saving, is a procedure which needs to be modified and its incidence minimized as the ultimate aim of a surgeon – "to perform a surgery which is without any morbidity and mortality and is well accepted by a patient", will never be fulfilled by constructing a stoma. We now stand in an era of greater scientific advancements, more so in the field of surgery wherein we try as much as possible to minimize the construction of a stoma. This study would throw more perspective on where we currently stand in terms of a stomal construction and management.

A total of 50 patients were included in the study who underwent stoma formation at this hospital from May 2011 to Nov 2013. The study included both emergency and elective conditions in which stoma was constructed.

- Most of the patients belonged to two age groups (36-45) and (56-65) n=26 each. Only one patient presented above the age of 65. The high incidence of cases in the above age group could be attributed to the incidence of malignancies, inflammatory bowel disorders and intestinal perforations, all of which present most commonly in the above age groups.
- 76% of patients who were included in the study were males (n=38). Only 24% were females. None of the parameters that were studied showed a significant variation according to the sex of the patient. A high male incidence could also be attributed to the above mentioned conditions which also predominate amongst males.
- A total of 17 patients, for whom the stoma was constructed, had hollow viscous perforation. Although the site of the perforation varied, the intra-operative findings warranted a stoma in these patients. Loop ileostomy was the most commonly performed surgery (n=16) amongst patients who presented with hollow viscous perforation as the perforation was most commonly located in the ileum or the base of appendix. Only one patient (n=1) underwent a transverse loop colostomy for a perforation in the sigmoid colon. Malignant bowel obstruction was the second most common cause (n=8). Patients with malignant bowel obstruction needed a stoma either for decompression or diversion (n=4 each). All patients with decompression were done a transverse loop colostomy whereas patients

requiring diversion were done a loop ileostomy, end ileostomy or an end colostomy according to the level and severity of obstruction. Benign cause of intestinal obstruction was the third most common etiological factor associated with construction of a stoma. However it is worth noting that benign diseases accounted for 78% (n=39) of all causes of stoma placement.

- Stoma was most commonly constructed on an emergency basis which accounted for 92% of the cases (n=46). Similarly, diversion was the most common indication for stoma accounting for 92% (n=46).
- Loop ileostomy was the commonly constructed stoma which accounted for 56% (n=28). Most common indication for loop ileostomy was hollow viscous perforation which was seen in 16 patients. Penetrating abdominal trauma and intestinal obstruction were seen in 4 patients each. Loop ileostomy was primarily constructed for diverting the enteric contents. In most cases, it was done along with a resection and primary anastomosis (n=12) followed by primary closure of the perforated bowel, most commonly ileum (n=9). Following loop ileostomy, transverse loop colostomy was the second most commonly constructed stoma (n=10). Predominant indication of transverse loop colostomy was a malignant bowel obstruction. The need for transverse loop colostomy was primarily to divert the entry contents (n=6), and decompression as an indication for a stoma was seen only in 4 patients.

- Amongst the 50 patients, complications were reported only in 12 patients (24%), while 38 patients (76%) were asymptomatic throughout their course of treatment. The complications reported were local sepsis (n=5), necrosis (n=3), hernia (n=2), prolapse and retraction (n=1 each).Most of the complications were reported in patients for whom a loop ileostomy was constructed (n=7) followed by end ileostomy (n=3). Local sepsis predominated in the above two groups of stoma also. This is of no surprise as an ileostomy has traditionally been associated with more complications than a colostomy. It is worth noting that a transverse loop colostomy was not associated with any complications at all.
- Amongst the various complications encountered,two major complications in terms of hernia and prolapse were associated with elective surgeries, whereas most of the local complications which could be related to improper surgical technique or positioning of stoma were associated only with emergency surgeries. Our findings are consistent with those by Stothert et al , who reported over 50% morbidity and 18% mortality following emergency surgery resulting in a stoma.
- Most of the complications were managed non-surgically. Two patients needed surgical repair - One patient with a parastomal hernia required operative management in the form of mesh repair and another patient with local sepsis was managed by repositioning of stoma in the left iliac fossa. Most of the patients with local sepsis were however managed with

topical application of Zinc Oxide and daily dressing of the wound alone and they responded adequately to this form of conservative treatment. Interestingly, patient compliance was good to average in nearly 90% of the patients. It is worth noting that few of these patients (n=7) in fact had major complications in the form of prolapse, hernia, retraction and even necrosis.

- Compliance was graded as good, average and poor based on patients' acceptance of the procedure as a life saving measure and whether he would consent to the same if needed again. Patients who had no complications had consented for the same and most of the patients with long term complications also had consented . Only patients who had local sepsis were unwilling to consent for the same in future, if presented with the same clinical scenario. Hence , poor compliance was seen only in 5 patients and all had local sepsis as a complication. This clearly shows that a condition that hindered with the day to day living of the patient in a bigger scale affected the overall acceptance of the procedure. Most of the cases had factors such as age, urgency of diagnosis and intra-operative findings as possible contributing factors for local complications, nevertheless a poorly constructed stoma and improper positioning of the stoma, primarily owing to obese body habitus still persist as the major causative factors for local complications. Hence, adhering to measures such as marking the stoma preoperatively, improving surgical technique

and providing better postoperative care would improve patient acceptance and hence success of the procedure. These results are not in concordance with those obtained by other studies which primarily emphasize that patient factors determine the outcome in a major way.

CONCLUSION

Stoma was most commonly constructed in males in the age group of 36-45 and 56-65. It was most commonly constructed for diversion of enteric contents on an emergency basis. Overall, benign disorders accounted for most cases and hollow viscus perforation, commonly involving the ileum and appendicular base was the commonest cause. Predictably, temporary stomas were most commonly constructed with loop ileostomy being the commonest. 76% of the patients did not have any complications and in the remaining few, local sepsis was the most commonly encountered. Patient compliance ranged from good to poor and the single most important factor which predicted a uniformly poor outcome was local sepsis. The type of stoma did not influence the advent of complications, although it is worth noting that patients with transverse loop colostomy did not have any complications. Most patients with poor compliance were managed conservatively and only two patients, with a hernia and a prolapse needed an operative interference. Overall, most patients tolerated the surgery and post operative period well.

BIBLIOGRAPHY

1. Dinnick T. The origins and evolution of colostomy. *Br J Surg*; 1934 22: 142–153.
2. Paul FT. A method of performing inguinal colostomy, with cases. *Br Med J*;

   1891 2:118.
3. Bass EM, Pino AD, Tan A, et al: Does preoperative stoma marking and education by the enterostomal therapist affect outcome?. *Dis Colon Rectum* 1997; 40:440-442.
4. Kock NG. 1973 Continent ileostomy. ProgrSurg; 12:180–201.
5. Eugene D. Gierson, MD; F. Kristian Storm, MD Blow hole cecostomy, an analysis A*rch Surg.* 1975;110(4):444-445.
6. D D Clark and C Hubay tube cecostomy, an analysis of 161 cases. Ann Surg. 1972 January; 175(1): 55–61.
7. Unti JA, Abcarian H, Pearl RK, et al: Rodless end-loop stomas: A seven-year experience. *Dis Colon Rectum* 1991; 34:999-1004.
8. Leenen LPH, Kuypers JH: Some factors influencing the outcome of stoma surgery. *Dis Colon Rectum* 1989; 32:500.
9. Steele SR, Lee P, Martin MJ, et al: Is parastomal hernia repair with polypropylene mesh safe?. *Am J Surg* 2003; 185:436.

10. Allen-Mersh TG, Thomson JP: Surgical treatment of colostomy complications. *Br J Surg* 1988; 75:416.
11. Makela JT, Turku PH, Laitinen ST: Analysis of late stomal complications following ostomy surgery. *Ann ChirGynaecol* 1997; 86:305.
12. Prian GW, Sawyer RB, Sawyer KC: Repair of peristomal colostomy hernias. *Am J Surg* 1975; 130:694.
13. Amin SN, Armitage NC, Abercrombie JF, Scholefield JH: Lateral repair of parastomal hernia. *Ann R CollSurgEngl* 2001; 83:206.
14. Sugarbaker PH: Peritoneal approach to prosthetic mesh repair of paraostomy hernias. *Ann Surg* 1985; 201:344
15. Leenen LPH, Kuypers JH: Some factors influencing the outcome of stoma surgery. *Dis Colon Rectum* 1989; 32:500.
16. Park JJ, Del Pino A, Orsay CP, et al: Stoma complications: The Cook County Hospital experience. *Dis Colon Rectum* 1999; 42:1575.
17. Duchesne JC, Wang YZ, Weintraub SL, et al: Stoma complications: A multivariate analysis. *Ann Surg* 2002; 68:961.
18. Pearl RK, Prasad LM, Orsay CP, et al: Early local complications from intestinal stomas. *Arch Surg* 1985; 120:1145.
19. Tang CL, Yunos A, Leong AP, et al: Ileostomy output in the early postoperative period. *Br J Surg* 1995; 82:607.

20. Szilagyi A, Shrier I: Systematic review: The use of somatostatin or octreotide in refractory diarrhea. *Aliment PharmacolTher* 2003; 15:1889.

21. Saghir JH, McKenzie FD, Leckie DM: Factors that predict complications after construction of a stoma: A retrospective study. *Eur J Surg* 2001; 167:531-534.

22. Makela JT, Turku PH, Laitinen ST: Analysis of late stomal complications following ostomy surgery. *Ann ChirGynaecol* 1997; 86:305

23. Mylonakis E, Scarpa M, Barolla M, et al: Life table analysis of hernia following end colostomy construction. *Colorect Dis* 2001; 3:334.

24. Christie PM, Knight GS, Hill GL: Comparison of relative risks of urinary stone formation after surgery for ulcerative colitis: Conventional ileostomy vs. J-pouch—a comparative study. *Dis Colon Rectum* 1996; 39:50

25. Christie PM, Knight GS, Hill GL: Metabolism of body water and electrolytes after surgery for ulcerative colitis: Conventional ileostomy versus J-pouch. *Br J Surg* 1990; 77:149

26. Voitk A: Simple technique for laparoscopic paracolostomy hernia repair. *Dis Colon Rectum* 2000; 43:1451.

27. Price AL, Rubio PA. Laparoscopic colorectal surgery: a challenge for ET nurses. *J Wound Ostomy Continence Nurs* 1994;21:179-182

28. Bricker EM. Bladder substitution after pelvic evisceration. *SurgClin North Am* 1950; 30:1511

29. Butcher HR Jr, Sugg WL, et al. Ileal conduit method of ureteral urinary diversion. *Ann Surg* 1962; 156:682

30. Deol ZK, Shayani V. Laparoscopic stomal repair. *Arch Surg* 2003;138:203-205

31. Amin SN, Armitage NC, Abercrombie JF, Scholefield JH: laparoscopic repair of stomal hernia. *Ann R CollSurgEngl* 2001; 83:206.

ANNEXURE 1- PROFORMA

NAME AGE SEX

ADDRESS UNIT

IP NO

OCCUPATION

DOA DOS DOD

PRESENTING COMPLAINTS

DURATION OF COMPLAINTS

ANY SIGNIFICANT PAST/PRESENT HISTORY

ANY SIGNIFICANT COMORBIDITY

PHYSICAL EXAMINATION:

- Level of consciousness
- Orientation
- Hydration status
- Anemia
- Jaundice
- Vitals

- CVS/RS
- Abdomen
- CNS
- P/R; P/V
- External genitalia

INVESTIGATIONS:

BLOOD

- Complete hemogram
- Renal Function tests
- Serum electrolytes

XRAY ABDOMEN ERECT

USG ABDOMEN

CT ABDOMEN AND PELVIS

PARAMETERS ASSESSED INTRA OPERATIVELY

Nature of presentation

Intraoperative findings

Definitive management

Need for stoma

Type of stoma

POST OPERATIVE PERIOD

IMMEDIATE

- Fever
- Electrolyte imbalance
- Laparotomy Wound Infection
- Wound dehiscence
- Sepsis
- Re-laparotomy
- Length of stay in hospital

LATE

- Stomal Prolapse
- Parastomal hernia
- Stomal stricture
- Ischemia
- Colostomy necrosis
- Eczema/Infections
- Malnutrition

S.NO	NAME	AGE	SEX	IP NO.	DIAGNOSIS	NATURE OF PRESENTATION	INTRA-OPERATIVE FINDINGS	TREATMENT	NEED FOR STOMA	TYPE OF STOMA	COMPLICATIONS	PATIENT COMPLIANCE
1	dilli bai	38	male	106961	intestinal obstruction – benign	emergency	gangrene of ileum with fecal peritonitis	resection and anastomosis of ileum	diversion	loop ileostomy	nil	good
2	veeran	58	male	107844	intestinal obstruction – malignant	emergency	rectal growth with dilated proximal bowel	colostomy	decompression	transverse loop colostomy	nil	good
3	karpagam	60	female	105781	intestinal obstruction – benign	emergency	gangrene of ileum with fecal peritonitis	resection and anastomosis of ileum	diversion	loop ileostomy	local sepsis	poor
4	soundara pandian	32	male	108808	hollow-viscus perforation	emergency	gangrene of appendix with perforation at base	appendectomy	diversion	loop ileostomy	nil	average
5	nagaraja	40	male	109702	penetrating abdominal trauma	emergency	gangrene of transverse colon	resection and anastomosis of transverse colon	diversion	loop ileostomy	local sepsis	poor
6	rafiq	18	male	109850	penetrating abdominal trauma	emergency	rectal perforation	primary closure	diversion	transverse loop colostomy	nil	good
7	asha	50	female	110230	penetrating abdominal trauma	emergency	gangrene of transverse colon	right hemicolectomy	diversion	loop ileostomy	nil	good
8	venkatesh	44	male	110634	intestinal obstruction – benign	emergency	sigmoid volvulus - dilated gangrenous sigmoid colon	sigmoid colectomy	diversion	transverse loop colostomy	nil	good
9	nagappan	64	male	111104	hollow-viscus perforation	emergency	ileal perforation with fecal peritonitis	primary closure	diversion	loop ileostomy	local sepsis	poor
10	vijaya	40	female	111660	hollow-viscus perforation	emergency	ileal perforation with fecal peritonitis	primary closure	diversion	loop ileostomy	nil	average
11	selvaraj	65	male	112010	intestinal obstruction – benign	emergency	gangrene of ileum with fecal peritonitis	resection and anastomosis of ileum	diversion	loop ileostomy	nil	good
12	vesudevan	33	male	112115	intestinal obstruction – malignant	emergency	ascending colon growth with dilated proximal bowel	right hemicolectomy with ileo-transverse anastomosis	diversion	loop ileostomy	nil	good
13	rajendran	50	male	112481	penetrating abdominal trauma	emergency	ileal perforation with fecal peritonitis	primary closure	diversion	loop ileostomy	nil	good

14	*mustafa*	*38*	*male*	*113141*	*hollow-viscus perforation*	*emergency*	*gangrene of appendix with perforation at base*	*appendectomy*	*diversion*	*loop ileostomy*	*nil*	*good*
15	*vijaya*	*45*	*female*	*113886*	*intestinal obstruction – malignant*	*emergency*	*descending colon growth with dilated proximal bowel*	*colostomy*	*decompression*	*transverse loop colostomy*	*nil*	*good*
16	*visalatchi*	*21*	*female*	*114814*	*hollow-viscus perforation*	*emergency*	*ileal perforation with fecal peritonitis*	*primary closure*	*diversion*	*loop ileostomy*	*local sepsis*	*poor*
17	*maheswari*	*25*	*female*	*115117*	*blunt abdominal trauma*	*emergency*	*hemoperitoneum with mesenteric tear and gangrene of ileo-cecum*	*right hemicolectomy with ileo-transverse anastomosis*	*diversion*	*loop ileostomy*	*nil*	*good*
18	*mayan*	*25*	*male*	*113*	*hollow-viscus perforation*	*emergency*	*giant perforation of ileum with with peritonitis*	*resection and anastomosis*	*diversion*	*loop ileostomy*	*nil*	*good*
19	*surya narayanan*	*36*	*male*	*468*	*hollow-viscus perforation*	*emergency*	*multiple ileal perforation with fecal peritonitis*	*resection and anastomosis*	*diversion*	*loop ileostomy*	*necrosis*	*average*
20	*shami ulla*	*42*	*male*	*11451*	*hollow-viscus perforation*	*emergency*	*sigmoid perforation with peritonitis*	*sigmoid colectomy*	*diversion*	*transverse loop colostomy*	*nil*	*good*
21	*raj kumar*	*25*	*male*	*1964*	*hollow-viscus perforation*	*emergency*	*ileal perforation with fecal peritonitis*	*primary closure*	*diversion*	*loop ileostomy*	*nil*	*good*
22	*dinesh*	*22*	*male*	*2101*	*hollow-viscus perforation*	*emergency*	*ileal perforation with fecal peritonitis*	*primary closure*	*diversion*	*loop ileostomy*	*nil*	*good*
23	*rajesh*	*30*	*male*	*2064*	*blunt abdominal trauma*	*emergency*	*gangrene of ileum with fecal peritonitis*	*resection and anastomosis*	*diversion*	*loop ileostomy*	*nil*	*good*
24	*amit*	*18*	*male*	*2190*	*hollow-viscus perforation*	*emergency*	*gangrene of appendix with perforation at base*	*appendectomy*	*diversion*	*loop ileostomy*	*nil*	*good*
25	*elangovan*	*38*	*male*	*2263*	*inflammatory bowel disease*	*elective*	*ulcerative colitis with perforation*	*total procto colectomy*	*diversion*	*end ileostomy*	*hernia*	*average*
26	*rajeswari*	*50*	*female*	*12713*	*hollow-viscus perforation*	*emergency*	*giant perforation of ileum with with peritonitis*	*resection and anastomosis*	*diversion*	*loop ileostomy*	*nil*	*good*
27	*vijaya*	*60*	*female*	*113886*	*ca rectum*	*elective*	*growth - lower 1/3 of rectum*	*abdomino perineal resection*	*diversion*	*end colostomy*	*prolapse*	*good*
28	*shanthi*	*55*	*female*	*3614*	*intestinal obstruction – malignant*	*emergency*	*cecal growth with dilated proximal bowel*	*right hemicolectomy*	*diversion*	*end ileostomy*	*hernia*	*good*

29	*saravanan*	*40*	*male*	*4848*	*peri-anal sepsis*	*emergency*	*peri-anal abscess with extension into perineum*	*incision and drainage*	*diversion*	*loop colostomy (sigmoid)*	*retraction*	*good*
30	*sebastian*	*22*	*male*	*5435*	*hollow-viscus perforation*	*emergency*	*multiple ileal perforation with fecal peritonitis*	*resection and anastomosis*	*diversion*	*loop ileostomy*	*nil*	*good*
31	*johnson*	*63*	*male*	*5199*	*intestinal obstruction – malignant*	*emergency*	*growth rectum with ifiltration into the bladder wall and sacrum*	*colostomy*	*diversion*	*transverse loop colostomy*	*nil*	*good*
32	*michael*	*22*	*male*	*5970*	*hollow-viscus perforation*	*emergency*	*ileal perforation with fecal peritonitis*	*primary closure*	*diversion*	*loop ileostomy*	*nil*	*good*
33	*nagappan*	*60*	*male*	*5957*	*diverticular disease*	*emergency*	*sigmoid diverticulitis with peri-colic abscess*	*laparotomy, drainage of abscess*	*diversion*	*transverse loop colostomy*	*nil*	*good*
34	*hemnath*	*58*	*male*	*6204*	*intestinal obstruction – malignant*	*emergency*	*descending colon growth with dilated proximal bowel*	*colostomy*	*decompression*	*transverse loop colostomy*	*nil*	*good*
35	*subramani*	*43*	*male*	*6802*	*acute mesenteric ischemia*	*emergency*	*sma occlusion with gangrene of jejunum and ileum , patchy and segmental.*	*resection and stoma*	*diversion*	*proximal jejunostomy and end ileostomy*	*nil*	*good*
36	*arivalagan*	*52*	*male*	*8244*	*hollow-viscus perforation*	*emergency*	*multiple ileal perforation with fecal peritonitis*	*resection and anastomosis*	*diversion*	*loop ileostomy*	*necrosis*	*average*
37	*syed*	*45*	*male*	*9012*	*peri-anal sepsis*	*emergency*	*peri-anal abscess with extension into perineum*	*incision and drainage*	*diversion*	*loop colostomy (sigmoid)*	*nil*	*good*
38	*sundaramoorthy*	*40*	*male*	*10145*	*hollow-viscus perforation*	*emergency*	*ileal perforation with fecal peritonitis*	*primary closure*	*diversion*	*loop ileostomy*	*nil*	*good*
39	*anbu*	*47*	*male*	*9876*	*intestinal obstruction – benign*	*emergency*	*gangrene of sigmoid colon with fecal peritonitis*	*resection and anastomosis of sigmoid colon*	*diversion*	*transverse loop colostomy*	*nil*	*good*
40	*mary*	*48*	*female*	*11624*	*intestinal obstruction – malignant*	*emergency*	*ca ovary with rectal deposits and intestinal obstruction*	*colostomy*	*decompression*	*transverse loop colostomy*	*nil*	*good*
41	*perumal*	*60*	*male*	*12153*	*hollow-viscus perforation*	*emergency*	*multiple ileal perforation with fecal peritonitis*	*resection and anastomosis*	*diversion*	*loop ileostomy*	*necrosis*	*good*

42	*murali*	*25*	*male*	*12692*	*penetrating abdominal trauma*	*emergency*	*perforation of transverse colon with peritonitis*	*primary closure*	*diversion*	*loop ileostomy*	*nil*	*good*
43	*ravi*	*26*	*male*	*13347*	*intestinal obstruction – benign*	*emergency*	*obstructed inguinal hernia with gangrene of ileum and fecal peritonitis*	*resection and anastomosis of ileum*	*diversion*	*loop ileostomy*	*nil*	*good*
44	*kumar*	*59*	*male*	*18101*	*diverticular disease*	*emergency*	*sigmoid diverticulitis with perforation*	*sigmoid colectomy*	*diversion*	*loop ileostomy*	*nil*	*good*
45	*kannagi*	*35*	*female*	*18386*	*intestinal obstruction – malignant*	*emergency*	*ca recto-sigmoid with obstruction*	*hartmann's procedure*	*diversion*	*end colostomy*	*nil*	*good*
46	*chakrapani*	*58*	*male*	*4916*	*inflammatory bowel disease*	*emergency*	*ulcerative colitis with perforation*	*total procto colectomy*	*diversion*	*end ileostomy*	*nil*	*average*
47	*subramani*	*75*	*male*	*12274*	*acute mesenteric ischemia*	*emergency*	*sma occlusion with gangrene of jejunum and ileum , patchy and segmental.*	*resection and stoma*	*diversion*	*proximal jejunostomy and end ileostomy*	*nil*	*average*
48	*kannama*	*50*	*female*	*11683*	*intestinal obstruction – benign*	*emergency*	*gangrene of ileum with fecal peritonitis*	*resection of gangrenous ileum*	*diversion*	*end ileostomy*	*local sepsis*	*poor*
49	*ramalingam*	*60*	*male*	*12678*	*ca rectum*	*elective*	*growth - lower 1/3 of rectum*	*abdomino perineal resection*	*diversion*	*end colostomy*	*nil*	*average*
50	*murugavel*	*65*	*male*	*12990*	*ca rectum*	*elective*	*growth - lower 1/3 of rectum*	*abdomino perineal resection*	*diversion*	*end colostomy*	*nil*	*good*
50	*murugavel*	*65*	*male*	*12990*	*ca rectum*	*elective*	*growth - lower 1/3 of rectum*	*abdomino perineal resection*	*diversion*	*end colostomy*	*nil*	*good*